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JOURNAL OF THE SOCIETY OF
CHEMICAL INDUSTRY
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REVIEW

SOCIETY OF CHEMICAL INDUSTRY.

CO-OPERATION IN PUBLICATION.

The memorandum submitted by the Federal Council for Pure and Applied Chemistry for co-operation in the publication of chemical literature, which we have been allowed to bring before our members through the courtesy of our President, Sir William Pope, who is also the Chairman of the Federal Council, is one of great moment to this Society.

The outstanding national importance of securing a full record of chemical literature so that we are no longer dependent upon the publications of other countries is recognised on all sides, and the need for co-operation is equally evident if this desirable objective is to be achieved. Such co-operation has been in the minds of many for a considerable period, but the initial difficulties in the way of its successful realisation, with due regard to the individuality of each of the Societies concerned, have hitherto proved a serious barrier. The conditions that have resulted from the war and the present economic pressure have accentuated the need from every point of view, and it is accordingly to be hoped that the present proposal will be considered from a wide and comprehensive standpoint and with a broad outlook towards the future of pure and applied chemistry in this country.

The memorandum, which was drawn up by the Federal Council at its meeting held on November 3, was accompanied by a covering letter suggesting that the Councils of the Chemical Society and of this Society should each appoint four representatives to meet as a Joint Committee to discuss the questions raised; this suggestion has been acted upon, and the representatives have been instructed to report the results of their deliberations to their respective Councils as well as to the Federal Council.

From the standpoint of this Society this proposal brings with it a welcome opportunity for a full consideration of the Society's publications. Our Journal is our great asset, and the Council and the Publications Committee fully realise their responsibility to make it as efficient as possible, and to maintain its high standard and reputation. The Transactions, the Abstracts and the Review represent a record of chemical literature which has proved of the utmost value and which must be maintained in any co-operative scheme of publication. For progressive development, responsible, informed and constructive proposals will always be welcomed, and we look especially to the younger members for help in this direction. Both in the interests of this Society and in the wider interests of the chemical industries of the nation, the improvement of our chemical literature and its more efficient organisation merit serious attention and wise counsel if we are to march successfully in the competitive advance of science and its technical applications.

ON CHEMICAL PERIODICAL LITERATURE.

(Memorandum from the Federal Council for Pure and Applied Chemistry.)

In past years the desirability of closer co-operation for publication between the several societies which issue chemical journals has often been discussed, but, although certain minor mutual arrangements have been made, no effective joint action has been taken. The main object has been to retain a high standard of publication and, in the absence of financial embarrassment, the extra cost of the luxury of independent publication has proved of quite secondary importance.

The recently established economic conditions have, however, introduced financial difficulties; our large chemical societies have had to raise their subscriptions and to abbreviate their publications. The two chief societies receive considerable financial assistance from their advertisements, which have notably increased during recent years; in fact, the Society of Chemical Industry draws a much larger income from advertisements than from the annual subscriptions of its members. With the disappearance of the Excess Profits Duty it is to be anticipated that advertisement matter will be more difficult to obtain; it is thus likely that further increases in the annual subscriptions will be necessary in the near future.

The whole subject of chemical periodical literature should therefore now be considered afresh in view of the incidence of economic pressure as a new factor. It seems necessary to consider whether our present method of dealing with the corporate interests of chemistry, as represented by periodicals, cannot be so modified as to ensure greater economy—that is, greater efficiency.

For the present it is perhaps convenient to restrict inquiry to the Chemical Society and the Society of Chemical Industry; at this preliminary stage the consideration of the circumstances of the many other societies having chemical interests will needlessly complicate the issues. The third large chemical society, the Institute of Chemistry, being a qualifying body, is so different in type from the other two that it also may be left out of immediate consideration. We may therefore consider in what way the incomes of the two large societies named above can be so expended as to yield a greater return to their members than is at present attained. As a preliminary it will be useful to note the practice in other countries.

In the United States, the American Chemical Society publishes original scientific papers in its monthly journal, which absorbed the *American Chemical Journal* some years ago, and also publishes monthly the *Journal of Industrial and Engineering Chemistry*, which contains ephemeral matter and market reports in addition to original papers on technical chemistry. This Society also issues *Chemical Abstracts*, a fortnightly publication which aims at abstracting every published article of chemical interest; it is now constructing a formula index to include inorganic as well as organic substances with a view to incorporating this in its decennial index.

In Germany, efforts were being made before the war to gather control of all the chemical periodical publications into one set of hands. In 1897, the German Chemical Society, which previously published abstracts as a part of the *Berichte*, acquired the *Chemisches Zentralblatt* and has since used this for the publication of chemical abstracts; in 1919, the *Chemisches Zentralblatt* was divided into two parts, scientific and technical, which now appear separately.* Later this Society secured to its members preferential rates of subscription to the *Zeitschrift für angewandte Chemie* and to *Liebig's Annalen* and, with its possession of the large compendia, such as "Beilstein" and "Richter," was evidently intending to concentrate all important periodic publications, academic and technical, under its own guidance.

In Holland, the *Nederlandsche Chemische Vereeniging*, numbering about 1000 members, issues a monthly journal of original scientific papers, the *Recueil des Travaux Chimiques des Pays-Bas*, and a weekly journal of technical and general interest, the *Chemisch Weekblad*, which also gives market prices. The Society also publishes the *Chemisch Jaarboekje* in three parts. The first part gives particulars of the Association and a list of its members and officers, together with a classified and indexed list of Dutch firms concerned with chemical products or necessaries, and states the specialities of these firms; the second consists of tables of constants similar to but smaller than Biedermann's *Kalender*. The third part forms a very extensive chemical bibliography stating in which of the Dutch libraries each journal or book is to be found.

In Italy, the Associazione Italiana di Chimica Generale ed Applicata publishes monthly the *Gazzetta Chimica Italiana*, a purely scientific journal, and also monthly the *Giornale di Chimica Industriale ed Applicata*, which contains technical, general, and commercial matter.

In France, the Société Chimique de France was until two years ago the only large chemical organisation; recently, however, the Société de Chimie Industrielle has been formed and has become very influential. As yet these two societies are entirely unconnected; each publishes its own original papers and abstracts. The relations between the two French societies seem practically identical with those which subsist between the Chemical Society and the Society of Chemical Industry.

In this country the Chemical Society issues the following publications:—

1. Transactions of the Chemical Society.
2. Abstracts of the Chemical Society.
3. List of members of the Chemical Society.
4. Annual reports on the progress of chemistry.

The Society of Chemical Industry issues the following:—

5. The Transactions, consisting of original papers.
6. The Review, containing matter largely of transient interest, with reviews of books.
7. The Abstracts of original papers and patents.
8. List of members of the Society.
9. Annual reports on the progress of technical chemistry.

Numbers 5, 6 and 7 are published together in fortnightly parts but with separate pagination.

The last inquiry showed that of the 3000 Fellows of the Chemical Society, and the 4000 members of the Society of Chemical Industry only 1000 are common to both; it appeared that an overlap of abstracts to the extent of about 15 or 20 per cent. occurred as between the two journals of abstracts, but it is probable that this is now reduced to little more than 5 per cent.

It is impossible to consider the above series of publications issued and the editorial establishments maintained by these two entirely independent societies without concluding that economies are possible. Further, the fact that information of ephemeral or popular interest only appears fortnightly in the *Journal of the Society of Chemical Industry*, has led to the appearance of weekly journals under private control which convey such information more promptly and, in addition, gain support from the more frequent distribution of advertisement matter; this factor naturally depreciates the value of the journals of the societies as advertising media.

The consideration of the tendency of foreign practice and of the circumstances of publication by the Chemical Society and the Society of Chemical Industry leads to the conclusion that increased economy and efficiency would be attained if they amalgamated into a "Chemical Federation" for purposes of publication. As to what set of publications they should issue provides matter for detailed discussion, and it is now only tentatively suggested that they should aim at the production of the following series:—

1. Transactions of the Chemical Society.
2. Transactions of the Society of Chemical Industry.
3. Chemical Abstracts, scientific and technical, purporting to be a complete collection of abstracts of original papers and patents, together with a list of books, Government reports, and the like.
4. A joint annual report on the progress of pure and applied chemistry.
5. A list of members of the chemical profession with their addresses and an indication of the societies to which they belong.
6. A weekly journal, containing the proceedings and notices of both societies, general summaries, reports of meetings, notices of books, parliamentary and legal information, company reports, market prices, notes of appointments, letters from correspondents, and the like.

Issues 1 and 2 would probably be made monthly and in much their present form. Issue 3 might appear fortnightly and aim at being as complete as the American *Chemical Abstracts*; it would probably be divided into scientific and technical sections like the *Zentralblatt*, and should be completed annually by a formula index, somewhat on the American plan, which could be employed in the production of complete indexes to the literature. Publication 5 could be made an indispensable chemical directory, giving particulars about learned and technical societies, possibly also lists of chemical firms and the like; it should be possible to secure the co-operation in this production of all the societies connected with chemistry, such as the Institute of Chemistry, the Society of Public Analysts, etc., with a view to their using this as their annual list of members. It could be made more complete by including particulars of chemical companies similar to those given in the Stock Exchange Year Book; its wide circulation would make it a valuable advertising medium, and it might thus pay for itself.

The weekly publication 6 should be more valuable for advertising purposes than our present journals.

In carrying out such a scheme as the above it would be possible to allow each Fellow of the Chemical Society to subscribe for 1, 3, 4, 5, and 6, and each member of the Society of Chemical Industry for 2, 3, 4, 5, and 6; also to obtain the remaining publication of the Chemical Federation at a reduced rate in the manner practised in the German Chemical Society. It would be necessary to apportion the financial outgoings and incomings as between the two societies; this involves purely actuarial work which can be safely left to professional hands.

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* [Since the memorandum was drawn up, certain changes in the modes of issue of the *Zentralblatt* and the *Zeit. f. angew. Chem.* have been notified for 1921 (*cf.* J., Dec. 31, 437 R).—ED.]

COMMITTEES OF COUNCIL AND REPRESENTATIVES ON OUTSIDE BODIES.

Publications Committee.—Messrs. C. A. Keane (convener), E. F. Armstrong, J. L. Baker, W. J. A. Butterfield, F. H. Carr, W. H. Coleman, S. H. Davies, W. R. Hodgkinson, G. T. Morgan, J. A. Reavell, W. F. Reid, and E. Thompson, with the following co-opted members: E. R. Bolton, C. F. Cross, J T. Dunn, E. Grant Hooper, J. R. Partington, W. J. Rees, and W. G. Wagner.

Finance Committee.—Messrs. E. V. Evans (convener), E. F. Armstrong, J. L. Baker, C. S. Garland, J. Gray, H. Louis, S. Miall, W. F. Reid, and E. Thompson.

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Technical, Research, and Allied Societies Committee.—Messrs. J. Allan (convener), E. F. Armstrong, W. A. Bone, J. W. Cobb, A. Holt, D. S. Jerdan, C. A. Keane, H. Levinstein, H. Louis, F. R. O'Shaughnessy, J. A. Reavell, and J. H. Young.

Government and Parliamentary Committee.—Messrs. W. F. Reid (convener), John Allan, J. L. Baker, W. A. Bone, Sir John Brunner, Bart., C. S. Garland, Sir R. A. Hadfield, Bart., S. Miall, and A. Rée.

Literary and Libraries Committee.—Messrs. W. J. A. Butterfield (convener), A. Holt, A. Lauder, R. L. Mond, G. T. Morgan, H. D. Smith, H. Talbot, and S. R. Trotman.

Emergency Committee.—The conveners of the above six committees; the General Secretary to act as convener.

The following have been nominated by the Council to represent the Society on outside bodies:—

Federal Council for Pure and Applied Chemistry.—Dr. C. A. Keane, Dr. S. Miall, and Mr. F. H. Carr.

National Physical Laboratory (General Board).—Sir Wm. J. Pope and Prof. F. G. Donnan.

Conjoint Board of Scientific Societies.—Dr. A. Holt and Dr. C. A. Keane.

Institute of Chemistry Standards Committee.—Dr. A. Holt, Prof. A. R. Ling, and Mr. W. G. Wagner.

British Empire Sugar Research Association.—Prof. A. R. Ling and Mr. J. W. MacDonald.

British Association Fuel Economy Committee.—Mr. E. V. Evans.

Industrial Alcohol Joint Committee.—Dr. E. F. Armstrong and Mr. D. Lloyd Howard.

British Engineering Standards Association.—Aircraft Sub-committee on Chemicals: Prof. W. A. Bone; Sub-committee on Textiles: Mr. C. F. Cross; Sub-committee on Dopes: Dr. J. N. Goldsmith.

Imperial Mineral Resources Bureau.—Lead, Silver, Zinc, and Cadmium Sub-committee: Mr. H. N. Ridge; Aluminium, Magnesium, and Sodium Sub-committee: Dr. R. Seligman; Minor Metals Sub-committee: Mr. W. G. Wagner; Chemical Industries (including Potassium) Sub-committee: Mr. C. S. Garland; Publications and Libraries Subcommittee: Mr. W. J. A. Butterfield; Abstracts Sub-committee: Prof. H. Louis and Mr. T. F. Burton.

NEWS FROM THE SECTIONS.

SHAWINIGAN FALLS.

The inaugural meeting was held on December 13, and was preceded by a dinner at which about sixty members and their guests were present.

The chairman, Dr. F. W. Skirrow, outlined the steps that had been taken to initiate the new Section, and read a cablegram from the President and Council wishing the Section every success on the occasion of its first meeting. Mr. G. MacIntyre then spoke and conveyed the good wishes of the Montreal Section.

The Hon. Walter Mitchell, Provincial Treasurer, addressed the meeting on the Province of Quebec, outlining its remarkable progress in regard to industry, transportation, and agriculture during recent years. The area of the Province, however, was so great—one-quarter that of the United States and five times that of the United Kingdom—and its natural resources so vast that its development had hardly begun. The Gouin administration had greatly increased expenditure on good roads, education, agriculture, and public works, but in such a judicious manner that the *per capita* debt had actually decreased during the past few years, a phenomenon unique in recent political history.

Development of the water-power resources by private capital had been encouraged and assisted by the Government, which even derived a profit from it, whilst the companies were able to sell power at very low rates. Of the 19 million available horse-power in Canada, Quebec possessed 6·85 million h.-p., and of this 875,000 h.-p. had been developed. The Gouin dam at La Loutre, which cost $2,500,000, and was serving an area of 300 sq. miles and impounding 160 billion cb. ft. of water, or twice as much as the Assouan dam in Egypt, had doubled the available horse-power on the St. Maurice River. In consequence, the large industrial towns of Grand'Mere and Shawinigan Falls had been built, and the village of Three Rivers had become a thriving city. Possible developments in other parts of the province were being studied by the Government. In concluding, the speaker pleaded for economy, co-operation between capital and labour, good sense, and good engineering in the difficult times now upon us, and predicted a period of prosperity greater than had been experienced in the past.

Mr. T. H. Wardleworth welcomed the new Section into the brotherhood of the Society which, he said, was not merely British, but imperial in character; as a vice-president, he was pleased to be able to endorse the cabled greeting from the President and Council in London. Great changes had taken place in the application of science to industry during the speaker's life-time. The period of "trial and error" had given way to insistence upon exact methods based upon well-ascertained facts, so that the chemist could reasonably anticipate results not only from laboratory experiments, but from the industrial development of new processes. Referring to the great care which Faraday bestowed upon his experimental researches, it was observed that although his mechanical and physical equipment was crude, his theories were nevertheless corroborated when modern refinements became available. Electricity had supplied the chemist of to-day with new powers and, in consequence, marked advances would be expected from a centre such as Shawinigan; it behoved every member of the new Section to see that these expectations were realised. Dealing with the relation of capital to chemical industry, the speaker emphasised the importance of the capitalist, and remarked upon the lack of education of wage-earners as revealed by thriftless habits. An appeal was made for a better understanding between capital and labour, as the vital interests of both depended upon active co-operation. The labour problem was not always a question of hours and wages, and this was especially true in a country like Canada which employed cosmopolitan labour; due allowance must be made for national customs and habits.

After a vote of thanks to the speakers had been moved by Mr. Stadler, seconded by Mr. Witherspoon, and replied to by Mr. Wardleworth, the meeting adjourned.

LONDON.

At the meeting held on January 3 at Burlington House, Mr. Julian L. Baker presiding, a paper by Mr. G. H. Thurston on "The Smith Continuous System of Carbonisation" was read, in the author's absence, by Colonel Brentnall. The carbonising process is carried out in two stages. In the first, coal of almost any description, after being dried with hot waste gases and crushed, is heated at 480° C. for 2 hours in cylindrical retorts lined with carborundum, the tar oils and gases being collected. The capacity of each retort is one ton of coal per hour, and mechanical stirrers are used to mix the charge and to move it forward from the inlet to the point of discharge. A coal with 35 per cent. volatile matter gives 5600—6700 cb. ft. of gas with calorific value 650—700 B.Th.U. The solid residue ("semicarbocoal") is briquetted with pitch and then heated for 6 hours at 1090° C. in inclined retorts; heavy oil, pitch, and ammonia are recovered from the volatile products, together with gas of 350—400 B.Th.U. "Carbocoal"—the residual solid—is stated to be an excellent smokeless domestic fuel, and also to be well suited for metallurgical, *e.g.*, blast-furnace, purposes, its crushing strain being 940 lb. per sq. in. The yields obtained from one ton of coal are:—14 cwt. of "carbo-coal," 10,080 cb. ft. of gas, 28 impl. galls. of tar, and 22·24 lb. of ammonium sulphate. The U.S. Government has assisted in developing the process, and two plants are now in operation, one at Irvington, N.J., producing 100 tons of "carbocoal" per day, and the other, at Clinchfield, Virginia, having a daily output capacity of 500 tons; the former has been working for two years and the latter since July, 1920. Over one hundred different kinds of coal have been successfully treated at Irvington, and although coals containing 30 to 35 per cent. of volatile matter are the best, quite inferior grades have been found to give satisfactory results.

Dr. Irvine Masson and Mr. T. L. McEwan contributed three papers on "The Recovery of Solvent Vapours from Air." In examining the processes of Brégeat and others, the authors have carried out a large number of determinations of the solubility of ether and alcohol vapours in cresol and other solvents. From the data obtained they have deduced a mathematical expression which correlates absorption with temperature and the vapour pressures of the solvents; and have shown how the results can be used to calculate the amount of liquid solvent and the number and dimensions of the absorption towers required in large-scale practice. The solvent vapours are best recovered from solution in cresol by steam distillation. Ether vapour may be absorbed with sulphuric acid of over 75 per cent. concentration, and recovered by distillation. Alcohol vapour is readily absorbed by this strength of sulphuric acid, and liberated by distillation after adding water to dilute the acid to 50 or 40 per cent. concentration. Cresol was found to be more efficient than sulphuric acid as a solvent for alcohol and ether, and by its use large quantities of these liquids were recovered during the war. The third paper dealt with the analysis of ether, alcohol and water mixtures.

PRESENT AND FUTURE POSITION OF THE CHEMICAL SOCIETIES OF GREAT BRITAIN.*

H. DROOP RICHMOND.

In 1914 the chemical societies were in a state of gentle activity, progressing slowly without any marked effort and reflecting the position of British chemical industry. The outbreak of war came as a sudden shock and revealed the facts that we had been dependent on other countries, notably Germany, for a very large portion of our chemical products, and had surrendered the position that we might have occupied. The reasons for this belong to the past, and any discussion of them opens such a wide question and has so little bearing on my subject that I simply record the fact; it is also a matter of recent history that British chemistry rose to the occasion, made up some of the leeway, and is now in the position it should have been many years ago. We have under the stress of necessity and at a great cost worked out for ourselves the fundamental principles of chemical manufacture of a large number of products which we did not make ourselves and have gained a knowledge which is approximating to that possessed by our competitors at the time when we commenced. We are not yet in a position to stand alone, for if we have learnt, so have they, and it will require more strenuous effort before we can compete in the world's markets.

The chemical societies helped in the national awakening, though under the conditions of stress the efforts made were largely individual and by groups, rather than by the chemists as an organised body; these conditions have ceased, and under the new circumstances we have time to work together to a common end, and the chemical societies can now take a large share in the advancement of British chemistry. Before the war there were four main bodies devoted entirely to chemistry:—The Chemical Society, for the advancement of pure chemistry; the Society of Chemical Industry, for that of applied chemistry; the Society of Public Analysts, for analytical chemistry; and the Institute of Chemistry, for the advancement of the profession of chemistry; and numerous other bodies, such as the Royal Society, the Royal Society of Arts, the British Association, and the Royal Institution, which promote the advancement of science including chemistry, and others, such as the Iron and Steel Institute, the Institute of Metals, the Biochemical Club, the Pharmaceutical Society, the British Pharmaceutical Conference, the Institute of Brewing, and many others which promote interests including more or less chemistry. Each society worked independently, though, partly from the fact that they had interests in common and partly because the prominent members of one body were often equally to the fore in the others, there was a certain amount of co-operation. The effect of the national crisis on the societies was, first of all, stagnation; then, as the outlook became clearer, the organisations of the societies were adapted to the national service, and each society has introduced changes to grapple with the altered economic conditions. It will be interesting to discuss those of the four purely chemical societies as indicating their present position.

The Chemical Society, which though localised in London is really a British society, has enlarged its scope to include the women chemists who helped to carry on during the war, and has initiated a scheme to render its library more generally available to all chemists.

The Society of Chemical Industry, which was the only body having local sections, has developed these and several new sections have sprung into being, notably in the Dominions and has some claim to be an Empire society. At the same time it has developed its central organisation in London, where many matters are dealt with without reference to its Sections, and has started an innovation in society journalism by publishing an ephemeral review of current chemical topics. A chemical engineering group has been formed.

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* Paper read before the Nottingham Section on November 24, 1920.

The Society of Public Analysts innovated a very useful section of "Notes" in its journal, but has not otherwise made any alteration. This body, though small and of restricted scope, is a British society and has always included a large proportion of provincial members on its council.

The Institute of Chemistry has undergone a remarkable change. Always a qualifying body, it has enlarged the scope of its qualifications very greatly, a very large number of members has been admitted without the examination formerly insisted on, and, curiously enough, at a time when a house primarily designed as an examination hall has been built has permanently relinquished a not inconsiderable proportion of its examination tests. Local sections have been started in many parts of the country, and these local sections have unofficially enlarged the scope of the activities of the society by discussing problems in chemistry as distinct from professional chemistry. It has started a Journal, an enlargement of the former Proceedings.

The enlargement of the activities of the Institute has been brought about by the formation of the British Association of Chemists, which threatened at first to engulf it, but which has now become a body primarily promoting the material interests of those chemists who are engaged in process and similar work. There is also the National Union of Chemical Workers, a trade union doing very useful work, and the British Association of Chemical Manufacturers, whose chief function is chemical policy, and the Federal Council has been formed to unite the whole of the societies for one common object.

The financial pinch has been felt by all the societies, and two years ago the Institute of Chemistry took the bold step of doubling its subscription to Fellows and students and increasing it by 50 per cent. to Associates; this step was not wholly brought about by war conditions, but was caused partly by the expiration of the lease just before the war and the greatly increased cost of the new premises; the increase was probably greater than was absolutely necessary, and gives a surplus devoted to increased activities.

The Society of Chemical Industry and the Chemical Society are now following suit with increases of 66 per cent. and 50 per cent. respectively, accompanied in the case of the latter by a 25 per cent. reduction in the entrance fee.

The Society of Public Analysts has not yet made any increase.

All the societies have made economies, the most noticeable being the suppression of the list of members usually issued annually, and the discontinuation of authors' copies by the Society of Chemical Industry, and generally each society has economised in minor matters.

The Chemical Society and the Society of Public Analysts have made few obvious failures, but in my opinion both the Institute of Chemistry and the Society of Chemical Industry are open to criticism. I have already stated my views before the Institute of Chemistry (*cf.* Proc. Inst. Chem., 1920, Vol. 2, p. 87), and in my opinion the Society of Chemical Industry spends too much on its central premises, and the Review portion of the Journal has not justified itself; as an ephemeral journal it appears with news too late and too trivial to meet the situation; the articles are often too weak, and it consists far too much of extracts from other papers on subjects not of great importance and interest to technical chemists. The greatest failure of all is common to the three societies that publish journals—the continual overlapping of matter published in chemistry.

British chemical science needs the societies, needs a journal of pure chemistry, a journal of technical chemistry and one of analytical chemistry, either combined with the technical journal or independent, a standard up-to-date lexicon of chemistry, a chemical directory, a complete and easily available chemical library, and an ephemeral journal. It has been suggested that the National Exchequer should be asked to provide funds for some or all of these objects, but apart from the public clamour against increased expenditure, it must be remembered that Government aid means Government control and red-tape, and I doubt whether the objects aimed at would not be hampered by this. The advancement of chemical knowledge has been the work of chemists in the past, and must remain so, and it is only chemists themselves who can do the work. We have managed to find the time and the money so far and must do so in the future; chemistry has been built by each man doing his bit and the more bits that each can do the less money is required, and there are many men who would do a bit or a larger bit if they could be fitted into the machine; as it is, many of us duplicate the work that others are doing.

I am a whole-hearted advocate of amalgamation; I see the greatest difficulties in bringing this about, but I do not see any that are unsurmountable if we all make up our minds. I think that the financial stringency is leading us to see more clearly that a fusion of interests makes for economy and avoids inefficient expenditure of our chemical resources; the avoidance of the duplication that now goes on will mean considerable saving in publishing expenses, our heaviest financial encumbrance.

All the societies are centralised in London, and it is doubtful if London has the same pre-eminence as the centre of chemical thought and industry as it has as the national capital, and I feel convinced that to centralise our chemical societies there results in a loss of chemical power which might be made available if the large provincial centres were to take a more active part. The Society of Chemical Industry and now the Institute have recognised this by local sections, which are in a very healthy state, and the Chemical Society and the Society of Public Analysts need the same organisation; chemists want opportunities to meet and thereby gather a wider outlook and see the problems in a different light. There is a tendency as a society grows to leave the routine work which was done in the early days by voluntary effort to salaried officials, and the more efficient the official the more he wants to do and the more important he tries to make his post; and as his view necessarily cannot be that of the members at large he will frequently branch off into spheres of activity which do not yield the best results to the members and which add to the expenditure. He is frequently supported by the older and more prosperous members of his council, who see the advantages partly from the point of view of their very capable official, and who are not obsessed with the constant idea of economy. The older men also have lost some of their pristine energy, and it will be to the advantage of the societies generally to have a proportion of young energetic men who will realise more truly than the leaders of the profession the needs of the members to leaven the ripe experience of the elder men.

Chemists have now fully come to the limit of what they can pay for the objects for which the societies were founded, and unless expenditure is watched carefully their work will not progress; they have not, however, yet come to the limit of the voluntary service they will give, especially if it is recompensed not only by experience gained but in addition by "kudos." There has never been any lack of persons who will take the honorary appointments, and I doubt if any chemist seeks payment for the original articles published under his name, and I believe many members would undertake voluntarily the work of local correspondents, indexers, contributors to a lexicon or bibliographers if the opportunity were given them. Purely clerical work, which must be done on the spot, editorial and journalistic work at which the amateur cannot hope to vie with the professional, and advertising (which is a profession by itself) must obviously be paid for, but much more voluntary work can be done than at present.

Since I wrote this Sir William Pope has sent me a letter which the Federal Council has addressed to both the Chemical Society and Society of Chemical Industry, and has given me permission to make use of it. Of the six publications suggested, the first three are obvious, and the fifth is one that I have already advocated in an even more extended form; I would only advocate that an editor with full powers should be appointed, who should have complete control of the journals, and that the publication committee should act only as consultant on questions of policy, leaving questions of detail to the editorial staff. About the annual reports I am not quite so convinced. Those of the Society of Chemical Industry are not in sufficient demand to make them pay, and I think the question as to their necessity should be considered very carefully. Personally, I read them with a very great interest, but I make no practical use of them. As to the weekly journal, this must be run on journalistic lines by a chemist and journalist combined and would compete with existing journals. My opinion is that it would be better to enter into an arrangement with one or more of the weekly trade journals rather than fight them.

The letter referred to modifies the propositions that I intended to make, and therefore I propose: (1) That the Society of Chemical Industry should forthwith accept the invitation of the Federal Council and nominate a representative of each of the Sections to consider the publication question; (2) that the representatives be empowered to offer the sectional organisations to other societies with a view to giving provincial members a more active part in the advancement of chemical knowledge; (3) that until joint publication is adopted the Society should purge its journal of the weak matter now published, include far more of the sectional proceedings, and strengthen the Publication Committee by adding elected representatives of every Section.

THE BRITISH SCIENTIFIC GLASS INDUSTRY.

EDWARD QUINE.

The Committee on Commercial and Industrial Policy, under the chairmanship of Lord Balfour of Burleigh, in its Interim Report on Certain Essential Industries stated that:—"There are certain special commodities which are essential to national safety as being absolutely indispensable to important British industries, and were supplied before the war entirely or mainly from enemy sources or from sources under present enemy control"; and in submitting recommendations in connexion with these industries the Committee further stated that:—"A group of industries in the case of which very special treatment is necessary is that of the optical glass and instruments and the chemical and laboratory glassware trades. The types of manufacture dealt with lie in the higher grades of the glass industry. To be successful they require specially skilled operatives and a direction not only commercial but possessing considerable scientific attainments. They carry meagre possibilities in direct profits, and as a result have not hitherto interested manufacturers in a degree in any sense commensurate with their importance in the industrial progress of the nation. Although comparatively small as regards the amount of capital required to be invested and of the labour employed therein, these industries are of vital national importance both on naval and military grounds and for all purposes of applied science and scientific research."

Optical Glass and Scientific Instruments.—Prior to the work of Schott and Abbe, a large portion of the optical glass required by British scientific instrument makers was made in the country, but the impetus and lead given by the researches of those scientists, which were supported by the Prussian Government, placed the German optical glass industry in such a commanding position that in 1914 only Messrs. Chance Bros., of Smethwick, were manufacturing optical glass in this country, and 80 per cent. of the optical glass used by British instrument makers, whose production was exceedingly small, was supplied by Germany.

The dependence of the safety of the nation upon the production of optical glass is clearly evident when it is appreciated that upon such glass depends the supply of range-finders, directors for artillery dial sights, gun sights, telescopes and binoculars, aeroplane-sighting and photographic instruments, trench and submarine periscopes.

Our position at the commencement of the war was truly alarming, and our armies took the field seriously handicapped owing to the predominance of our enemies in all instruments which may be termed the "eyes of the army."

During the war, although handicapped by shortage of skilled labour, by lack of materials, and by lack of knowledge of the manufacture of certain types of optical glass, British manufacturers and scientists laboured so successfully that before its termination practically every requirement of the scientific instrument maker, whether his products were required for the Forces or the laboratory, could be met by British optical glass.

To-day England can supply optical glass to meet all requirements of the British Empire in addition to those of foreign countries, and is producing certain types of optical glasses superior to those made in any other part of the world. The credit of this achievement is mainly due to the efforts and sacrifices of Messrs. Chance Bros., Messrs. Derby Crown Glass Co., Ltd., the late Mr. A. S. Esslemont, Sir Herbert Jaskson, and Dr. C. J. Peddle.

Chemical and Laboratory Glassware.—Chemical and laboratory glassware is that glassware which is used in laboratories for scientific purposes, and may be divided into two main classes:—(1) Hollow glassware, which is mainly manufactured at the glass furnace, *e.g.*, flasks, beakers, petri dishes, etc.; (2) articles of glassware which are made mainly from tubing at the blow-lamp flame, *e.g.*, thermometers, pipettes, X-ray tubes, etc.

It will be readily appreciated that the dyestuff, steel, chemical, explosive, gas, and metal industries require an adequate production of scientific glassware, as do also medical and research laboratories attached to hospitals, county and municipal laboratories devoted to public health and hygiene, and the various laboratories at universities, colleges, etc.; in fact, it may be fairly claimed that the scientific glass industry both in times of peace and war is the master "key" industry.

This industry was almost entirely in the hands of

Germany and Austria before the war, and practically the whole of the hollow-blown furnace-made glassware was obtained from these countries. It is almost equally true that the entire lamp-blown scientific glassware was obtained from foreign countries, although there existed in this country a small number of highly skilled workers at the blowlamp flame who produced the unrivalled English clinical thermometer and a limited number of types of chemical thermometers. In addition to these workers, there was a number of lamp workers who repaired damaged foreign glass apparatus, produced special lamp-blown glass apparatus, and tided over the difficulties of importers awaiting shipment of foreign-made glassware. These highly skilled glass workers could almost be counted on the fingers and belonged to the industrial class covered by the term "out-workers," whose premises were unpretentious and whose capital and apparatus were limited to a few pounds and a blowlamp. It was fortunate that the dealers in laboratory glassware had large stocks when war broke out; otherwise the production of munitions would probably have come to a very sharp end, and it was soon apparent to those familiar with this industry that should the war be a long one the situation would become exceedingly critical. Steps were taken to produce scientific glassware in this country, but this was an exceedingly difficult task, for though it was possible for the chemist to analyse glassware and evolve formulæ, the commercial manufacture of the glass presented enormous technical difficulties. With no previous experience of this industry to guide them except that of the domestic glassware and the bottle industry, our glass manufacturers tackled the problems. In their endeavours they met with reverse after reverse, for, apart from a lack of knowledge, inadequate materials and glasshouse equipment, there was no British labour trained to blow the light hollow ware required in laboratories. Stocks rapidly diminished, manufacturers were pressed for their production, and British-made scientific glassware was placed on the market in a condition which was as unsatisfactory to the manufacturers as to the users, and could only be termed "stop-gap." Steadily, however, and at the cost of great monetary loss, the production of scientific glassware was improved, and to-day our manufacturers are producing light hollow-blown scientific glassware which is superior in resistance to chemical reagents, and general utility, to that produced in any other country.

The lamp-blown section of the industry is dependent upon an adequate supply of glass tubing, and before the war there were few skilled tube-drawers in this country, and although efforts were made to train workers, this was an undertaking requiring time, for the operation is one requiring great physical endurance and manipulative skill; and in spite of exceedingly high wages, even at the close of the war the number of skilled tube-drawers in this country was lamentably small.

The skill required of the operator who manufactures a lamp-blown article from tubing varies from that required to make a simple article, such as an ampoule, to that required for making a high-grade thermometer or X-ray tube, and it was therefore possible to increase rapidly the number of workers engaged in the simpler operations; but the high degree of skill required, together with the demands of the recruiting authorities, prevented any large increase in the numbers of the highly skilled workers. Yet on this weak section of the industry, struggling against innumerable difficulties due to lack of adequate glass tubing, lack of manufacturing plant and lack of skilled labour, was thrown at one critical period of the war a responsibility in connexion with our anti-submarine campaign on the satisfactory discharge of which our national safety depended; and the glass-tube drawers and lamp-workers did not fail.

The demand for scientific glassware in the future will exceed that in the past, for it is obvious that the industrial progress and health of a community is becoming increasingly dependent upon its laboratories. Our Empire cannot afford to allow its industries, its health, and its safety in time of war to be dependent upon a commodity, the manufacture of which is controlled by a foreign nation.

We are, however, swiftly drifting into that position, for, owing to the difficulties experienced by manufacturers in developing the scientific glass industry, the high costs of building and equipment, and the strength and reputation of the German and Austrian manufacturers, the industry was never in a position to stand unaided against continental competition, and the rate of exchange has now made the position, without protection, hopeless.

The Standing Committee on Trusts, in its interim report just issued, says:—"The manufacturers of scientific glassware have incurred considerable losses since they undertook to manufacture this class of glassware, and although we are not able to report as to the fairness or unfairness of past and present prices, we consider that such temporary support should be afforded to this new industry as is consistent with fairness to consumers. If this were done, probably within reasonable time the industry would be able both to hold its own against foreign competition and to sell its productions at prices acceptable to the public."

Unrestricted importation of scientific glassware, however, is to-day crushing the British industry, and some manufacturers have been forced to cease production, others have discharged labour trained at great expense in the time of the nation's need, and soon, unless help in the way of preventing unfair continental competition is given, the industry will pass to Germany and Austria, and once more the Empire will depend upon our late enemies for that production which is most essential to our industrial progress and national safety.

REPORT OF THE RAILWAY RATES ADVISORY COMMITTEE.

A. J. MALACRIDA.
(Transport Manager, Association of British Chemical Manufacturers.)

The Railway Rates Advisory Committee after sitting in public for forty days has now presented to the Minister of Transport its report (Cmd. 1098, 9d.) on the principles which should govern the fixing of tolls, rates and charges for the carriage of merchandise by freight and passenger train and by other services. As the report is very comprehensive, consisting of 54 foolscap pages, it is not possible to consider all the important points it raises, but as many of the proposals are of vital importance to the chemical industry, it is essential that these should be treated at some length.

The two main principles advocated by the Committee in respect of the fixing of future rates are:—

(1) The charge must in no case be less than the cost to the railway company of rendering the required services.

(2) The charge must in no case be more than the value of the services to the trader.

This seems a very sound policy, especially so far as the chemical industry is concerned, because at the present time the rates which are charged for the conveyance of chemical commodities are out of all proportion to the cost to the railway companies and to the value of the service to the trader. It is not necessary to labour this point because it has already been fully dealt with in the articles which have appeared in previous issues of this *Journal*, by Mr. J. Lukes, traffic manager to Messrs. Brotherton and Co., Ltd.

In regard to the component parts of the new rates, the report states that all parties seem to be agreed that the present system should be continued, *i.e.*, there should be a rate for conveyance and separate rates for station accommodation and services rendered at the terminals at each end of the transit, and that owners of private sidings should only be charged for the services actually rendered to them, the proper rates being fixed for terminal charges at the same time as the conveyance rates. The Rates Advisory Committee recommends that a new tribunal should be set up to deal with the fixing of the rates, tolls and charges, and to the present writer this appears to be a great step forward, which should prove of much benefit to the trading community as a whole. At the present time the fixing of rates and charges is left entirely in the hands of the railway companies, so long as they do not exceed their maximum power and do not create undue preference in favour of one trader as against another. Apart from this the trader has no voice in the fixing of the rates and charges, and the recommendation now made should assist in the development of industry generally. To illustrate this one might instance many cases in which representations have been made to the railway companies that certain commodities could not bear the rates charged between particular points, and in which the companies have refused to grant reductions on the ground that although the traffic would not pass between the particular points in which a trader was interested, it would pass in other directions. In future, cases of this sort would be brought before the new tribunal, which would doubtless consider them from all points of view, and in all probability it would grant such rates as would enable traffic to move freely; and whilst perhaps the rate might be on a lower basis than the railways would usually approve, it might still be remunerative, having regard to the possibility of developing the industry and increasing the traffic put on the railways.

From the standpoint of the chemical industry, the most important feature of the suggested tribunal is that it would decide as to which articles are to be classed as "dangerous goods." The wording of the recommendation is perhaps not quite as clear as the industry would desire, yet it is thought that the suggestion is a great advance on the existing position. It is well known that at the present time the railway companies have absolute power under Section 105 of the Railway Clauses Consolidation Act, 1845, to specify which goods are dangerous, and this decision, if based on the *bona fide* judgment of the railways that the goods are dangerous, cannot be altered except by a repeal of the Statute. This is aptly illustrated in the case of *The Midland Railway and Others* v. *Messrs. Butler and Co. (Bristol), Ltd., and Messrs. Brotherton and Co., Ltd.*, in which the Railway and Canal Commissioners held that they could not alter the *bona fide* judgment of the railway company that certain goods were of a dangerous nature.

In addition to the new tribunal, the Rates Advisory Committee recommends that a body, to be called the Railway and Traders' Conference, should be set up to act as a Conciliation Board without coercive powers. The proposal is that in each of the great distributing centres of the country two panels should be set up, one consisting of representative traders, and the other of officials of the railway companies serving the district; and that from these panels a committee should be formed to which any traders having a grievance might make application, and which would have power to make recommendations but not to make or enforce orders. If a question appeared to involve general principles or an issue of great importance, the local tribunal would be empowered to refer it to the Rates Fixing Tribunal. The object of these local tribunals is to secure a hearing for traders who, although admitting that the railway authorities will usually redress a grievance if it be properly presented to them, nevertheless contend that their complaints are too often disposed of in a rough and ready manner by minor officials without adequate consideration.

Maximum and Actual Rates.—The maximum charges for the conveyance of merchandise which the railway companies are entitled to make under the Rates and Charges Order Confirmation Acts, 1891-92, were really a necessity so long as the railways were allowed to determine the actual rate, but as the power to fix rates is in future to be in the hands of the new tribunal, the Rates Advisory Committee suggests that it should also be entrusted with the determination of maximum rates. This appears very reasonable, seeing that the new tribunal is to have the power of raising or lowering rates after full investigation.

Continuous Mileage.—Throughout the evidence given by the traders, a general desire was expressed that the new system of fixing rates should be on the principle of continuous mileage, and not upon the cumulative principle now in operation. The effect of the cumulative principle is that rates for a distance of, say, 100 miles, when computed over two lines of railway, are greater than those for 100 miles when the transit is on one line of railway only; and the Rates Advisory Committee considers this state of things to be a serious anomaly. The railway companies strongly opposed the principle of continuous mileage, although actually many of the rates which they charge at the present time are based upon it, as are also, generally speaking, the receipts for the conveyance of merchandise when divided between the various railways, no regard being paid to any advantage that may have accrued where the rates are made upon the cumulative principle. The Rates Advisory Committee therefore recommends that in the case of through rates the principle of continuous mileage be adopted with provisions in the case of different rates prevailing on the railways involved similar to those in regard to portions of the railway having different maxima under the Railway Rates and Charges Orders.

One of the most important features of the recommendation relating to continuous mileage is its application to short distance traffic and to the fixing of the minimum charge. The report states:—"We consider the anomaly of making two minimum charges as for six miles each of transit, for possibly a total distance of four or five miles, as more objectionable than that of different charges for long-distance hauls according to whether the transit is on one or more railways." With the adoption of continuous mileage, the Rates Advisory Committee does not intend to interfere with the existing regulations, but to allow bonus mileage to be charged in respect of the portions of the lines which have been constructed at extraordinary expense, such as Runcorn Bridge, Forth Bridge, Severn Tunnel and lines in and around London. It is intended that such bonuses should continue to be charged, and in general indicated by the total distance being treated as being increased by the stipulated extra mileage. In those cases where different maxima have been fixed in respect of certain portions of the same railway, the Committee thinks that these differences should not be continued, but that a single rate sufficient to provide the desired revenue should be fixed for each class of goods upon the whole or each of the railways or groups.

Terminals and Disintegration of Rates.—Section 33, Sub-section 3, of the Railway and Canal Traffic Act, 1888, placed an obligation upon the railway companies to disintegrate rates when application is made by a trader, but the disintegrations which have been given by the companies in the past have been in such a form as to be practically useless to the trader asking for the information; and during the hearing the traders consistently urged that all rates in future should be disintegrated in such a manner as to show separately the difference between the amounts for conveyance and those for each of the services.

The railway companies are willing to concede that if standard rates and tariff are fixed by an independent authority, the rates and tariff so fixed should show the amounts to be charged for conveyance and for terminal accommodation and services separately, but they claim that there should be no obligation upon them to disintegrate exceptional rates or apportion any part of the charge to terminals. The Committee is of the opinion that there is "to some extent justice in the claims of the traders, but that the counter arguments of the railway companies ought not to be ignored," and it recommends that the conveyance rate and terminal charges should be separately specified in the standard rates to be fixed by the tribunal, and that when the tribunal is called upon to fix an exceptional rate it should specify how much of that rate is for conveyance and how much for each terminal.

In the main, the claims urged by the traders have been met in the recommendations of the Committee, and these will prove a great boon, especially to those traders whose works are connected with the railways by private sidings.

Services Rendered at or in connexion with Private Sidings.—The present position as regards private sidings is that the owner pays the conveyance rate, but is free from any general obligation to pay the terminal charges whether for station accommodation or services, but the Rates and Charges Order Confirmation Acts, 1891-92, provide that the railway companies may charge a reasonable sum for services rendered at or in connexion with traffic at sidings not belonging to the company, any difference arising under Section 5 of the Orders quoted to be determinable by an arbitrator appointed by the Board of Trade. In practice, however, the railways have made their charge for siding services the amount of the terminal charges that are included in the rate applicable to the nearest goods station. This may be the full statutory terminal charges or less, according to the amount of the rate charged.

Whilst the Rates Advisory Committee does not see any reason for altering this state of things, it recommends that the duty of determining any difference should be placed upon the new tribunal. With a view, however, to fixing the reasonable sum to be paid by the owner of a private siding during any period which may elapse before the question can be determined, either by an agreement or by a new tribunal, the Committee has framed a series of rules.

Other matters dealt with in the report are "Conditions Affecting Carriage by Rail," and the "Conveyance of Traffic at the Actual Gross Weight" (except in the case of timber).

The report, as a whole, is a very valuable document, and opens the way for a scheme whereby the railway rates of the future may be made very much simpler and therefore more helpful to all concerned. The traders have gained valuable concessions, which will doubtless be more appreciated as their effects come to be experienced.

CORRESPONDENCE.

RAIL CONVEYANCE OF CHEMICAL COMMODITIES.

Sir,—Mr. Lukes' article in the *Journal* of December 31 does not, I think, need a lengthy reply from me, and I would ask those who are interested in the subject to re-read my article in the *Journal* of November 15, and they can judge whether I succeeded in correcting the exaggerations in Mr. Lukes' first article, and whether he has now brought forward any new facts of material importance.

When Mr. Lukes asserts that the railway companies have the power to decide what goods are dangerous and the sum to be charged for their conveyance "whether their views be right or wrong," he exaggerates the facts. The law provides that the companies shall not exercise their powers unjustly, and their charges must be reasonable.

The quotation from the American Inter-State Commerce Commission Regulations appears to insinuate that the British railway companies have not conferred with manufacturers and shippers in regard to specifications and regulations for the packing and transport of dangerous goods, but Mr. Lukes knows that many such conferences have been held and amendments made as the result of such discussions. I do not know whether these conferences are compulsory in America, but I do know that the British railways are not compelled to hold such conferences, but have done so *voluntarily*.

In his reference to the test case heard before the Railway and Canal Commissioners, in the matter of the *North-Eastern Railway Co.* v. *Reckitt and Sons, Ltd.*, Mr. Lukes omits to mention that the presiding judge, Mr. Justice Bankes, stated in delivering his judgment:—"In my opinion, therefore, even if the test contended for by the defendants be applied, these goods are dangerous." Mr. Gathorne Hardy, although in some doubt, said:—"On the whole, especially having regard to the question of storing and warehousing, I cannot bring my mind to the conclusion that these are not dangerous goods." Sir James Woodhouse, although he held a different opinion, as stated by Mr. Lukes, made some very pertinent remarks which Mr. Lukes omits from his quotation. Sir James said, in reference to Section 105 of the Railway Clauses Act, 1845, and the companies' powers:—"*They must of course exercise the discretion vested in them with absolutely good faith and not for the indirect purpose of obtaining charges which they could not otherwise obtain. There is no suggestion of their acting otherwise in this case.*" (The italics are mine.) Mr. Lukes complains of the arbitrary powers given to the railway companies, but he has not given a single instance in which the Court has decided that these powers have been used by the companies in an unfair and arbitrary manner.

I stated in my article that the rates charged for dangerous goods had not been *generally* raised as a consequence of their transference from the White to the Yellow pages. Mr. Lukes gives no instance to the contrary. He mentions trinitrotoluol; but this substance always has been classified as a dangerous article, and the change made has been to transfer it from the category of Dangerous Chemicals to the list of Explosives, consequent upon the issue of an Order-in-Council, No. 898 of 1917, which definitely included it in the Authorised List. The rates charged for its conveyance automatically became the same as those charged for all other explosives of the same class.

As regards "Spirits of Tar" and "Mineral Tar Oil," no rates were raised. In these cases, the traders claimed to declare their traffics under names which did not correctly describe them, in order to obtain the benefit of lower rates, but the Court decided that these claims could not be upheld.

Private-siding rates and the contention that all railway rates should be based upon the actual cost and the capital actually employed in handling and conveyance of the particular traffic involved have been dealt with in the report of the Rates Advisory Committee recently issued by the Ministry of Transport, and no further word need be said here. This report also deals with the classification of dangerous goods, the railway companies' liability in connexion with them, the rates to be charged, and the indemnity against consequences. One clear statement in the report may be quoted which has been urged over and over again but never accepted by some traders or their representatives. It occurs on p. 10, and is as follows:—"But as soon as it is established that rates are from time to time to be so fixed that the railway companies (subject to the obligation of providing good management) are secure of receiving adequate net revenue, they have a much smaller concern in the question of lowering particular rates or classes of rates, being satisfied that the aggregate will be made good to them from some other source, while the traders generally have become deeply interested parties to the discussion, seeing that for the first time wherever a diminution of revenue is caused by concessions to one class it will have to be made good by throwing the burden to the rest of their body. In other words, whenever a proposal is made in the general revision of rates for favourable treatment for any class of commodities the general body of traders have a greater interest in opposing it than have the railway companies. Indeed, but for the fact that the knowledge and experience of the railway companies' officials are necessary to secure a scheme that will work smoothly and efficiently, those companies might stand on one side and say: 'Let the traders decide among themselves how they desire that the necessary revenue should be raised.'" May we hope that now that this truth has been pronounced by the "impartial business tribunal" appointed by the Ministry, on which there was only one railway representative, after an exhaustive inquiry, it will be accepted, and that the agitation founded on other ideas will cease?

In concluding these remarks, I again acknowledge with thanks the valuable assistance of some of my railway colleagues.—I am, Sir, etc.,

L. Archbutt.

MEETINGS OF OTHER SOCIETIES.

ROYAL SOCIETY OF ARTS.

Three Cantor Lectures on "Micro-organisms and some of their Industrial Uses" were delivered on November 29, December 13 and 20, by Mr. A. Chaston Chapman, Dr. M. O. Forster presiding.

Commencing with the discovery of zymase by Büchner, the lecturer briefly described Harden's work on the enzymic nature of fermentation, showing that the presence of a co-enzyme was as necessary as that of the zymase itself. The mechanism of alcoholic fermentation was then dealt with at some length, and it was shown that pyruvic acid and acetaldehyde were intermediate products formed during the fermentation of sugar under certain conditions.

The importance, from the point of view of chemical industry, of being able to modify cell-functions by varying their environmental conditions was indicated and illustrated by several examples. The production of glycerin on a large scale during the war by the fermentation of sugar was described and the results obtained in Germany and in the United States were referred to.

The Amylo process for the production of alcohol on the large scale was next dealt with somewhat fully, and the nature of the improvements in the process made during recent years and the directions in which further improvements might be looked for were indicated. It was pointed out that about 20 million hectolitres of absolute alcohol had been made on the Continent by this process since its introduction, twenty years ago, but that, owing to excise restrictions, it could not be employed in this country. The use of bacteria for liquefying starch in the Amylo process for the purpose of reducing the waste of nitrogen was also described.

Further illustrations of the technical application of microbiology to industrial chemistry were instanced in the manufacture of citric, pyruvic, and fumaric acids by so-called "fermentation" processes. The manufacture of lactic acid was somewhat fully described, and the lecturer pointed out the unprogressive character of the industry in this country, the technical conditions to-day being but little better than at the commencement. The manufacture of butyric acid was stated to be in an even worse position, as the best and most economical conditions for the biochemical production of this acid were far from being known. The manufacture of vinegar was next described, and it was pointed out that, although the industry is worked on sound lines—so far as the preparation of the alcoholic wash is concerned—it is on a much less satisfactory basis on the biological side. The working losses experienced at present are often very considerable, and most manufacturers have little or no knowledge of the actual biological character of the organism or organisms they are using.

At the commencement of the third lecture the biochemical production of butyl alcohol and acetone from starchy materials was dealt with, and reference was made to the results obtained during the war at King's Lynn, at H.M. Naval Cordite Factory at Holton Heath, and at the works of the British Acetone Co. at Toronto (cf. J., 1919, 271 T, 273 T, 282 T, 411 T). The mechanism of the process is very complex, and in order that it might compete with the ordinary process for the production of acetone, cheap raw material must be available, as well as a market for the butyl alcohol, the hydrogen formed and the constituents of the spent wash. The conversion of butyl alcohol into methylethylketone was a possible solution of one of the above problems.

The lecturer then referred to the use of certain of the lower fungi for the production of nitrogenous foodstuffs. Brewers' yeast constitutes a valuable cattle food or, when de-bittered, can also be used as a constituent of manufactured food products intended for human consumption. The use of yeast for the manufacture of an extract closely resembling extract of meat in its chemical and physical properties was referred to, and it was mentioned that a well-known brand of yeast-extract at present on the market had been found to be rich in the water-soluble vitamine or accessory growth substance, whilst meat extract had been found to be devoid of this important growth-promoting constituent.

The use, for food purposes, of the so-called "mineral yeast" in Germany during the war and its manufacture in this country were described (*cf.* J., 1919, 285 T). The discovery of a simple biochemical method for the conversion of cellulose into sugar was mentioned as affording a probable solution of the power alcohol problem and also of rendering possible the economical production of synthetic nitrogenous foodstuffs.

In conclusion, Mr. Chaston Chapman pointed out how backward England had been in connexion with important discoveries in the domain of industrial microbiology, and renewed his plea for the foundation of a National Institute devoted to that subject (*cf.* J., 1919, 282T). The function of such an institute would be to provide for the systematic prosecution of research in connexion with all those industries in which micro-organisms or enzymes play an important part. In addition to this it would serve as a centre for the specialised training of men intending to devote themselves to the teaching of microbiology and biochemistry in our universities and technical schools, as well as for the practical instruction of technical employees engaged in the various biochemical industries. It would also provide breweries, distilleries, and other factories with any required organisms in pure culture, and would serve generally as a central home for the promotion of microbiological science.

NEWS AND NOTES.

SOUTH AFRICA.

Lead and Vanadium in the Transvaal.—A deposit of lead and vanadium, probably of considerable extent, with a content of lead metal ranging from 8·15 to 15·5 per cent., and of vanadium pentoxide from a trace to 1·35 per cent., occurs at the old Doornhoek Lead Mine, Marico District.—(*S. Afr. J. Ind., Nov.*, 1920.)

Maroola Nuts as a Source of Oil.—A sample of Maroola nuts (*Sclerocarya caffra*—a tree that occurs extensively in the Transvaal), has been investigated at the Imperial Institute, which reports that the nuts consist of about 90 per cent. of shell (very tough and fibrous), and only about 10 per cent. of kernel. The kernels yielded 59·2 per cent. (dry basis) of a non-drying oil which would be suitable for soap manufacture and possibly for edible purposes. It is very improbable that the nuts could be used as a source of oil owing to the difficulty with which they are cracked and the kernels separated.—(*S. Afr. J. Ind., Nov.*, 1920.)

Platinum in the Lydenburg District.—Pending reliable information concerning the alleged important discovery of platinum in the Cala district, it may be recalled that this metal is known to occur in other parts of the Union. Pseudo-stratified segregations of chromite associated with platinum occur for considerable distances along the margin of the Bushveld granite area in the Transvaal. The segregations are several inches thick, and though of workable size and extent have never been exploited. The chromic-oxide content is usually between 35—45 per cent., but 54 per cent. in places, and the Mines Department of the Union states that the ores contain an appreciable quantity of platinum. Platinum and allied metals are also found in the black sands derived from the conglomerates in the Klerksdorp area, a district which is at present very inaccessible, but the occurrence is stated to be well worth attention.—(*Official.*)

Sulphur in South Africa.—The imports of sulphur into the Union of South Africa during 1913 and 1917 were as follows:—

	1913.	1917.
Sulphur (long tons) ...	2672 ...	899
Pyrites („) ...	22,903 ...	18,465
Sulphuric acid (lb.) ...	291,976 ...	37,435

Five factories in the country produce sulphuric acid for their own use, and for trade when supplies of pyrites and railway facilities are available. The present demand for pyrites amounts to 1650 tons per month; shortly it may be 3500 tons. Deposits of native sulphur are known to occur in the Union, but none of these, so far as is known, could be profitably worked. Railway facilities are needed for the development of the massive pyrites deposits occurring in the Areachap Copper Mine, 10 miles from the station. Disseminated pyrites is plentiful in the gold-bearing rocks and in the coal mines. It is estimated that during next year coking plants in the Union will supply about 450 tons of pyrites per month. Pyritic auriferous concentrates, derived from the Sandstone Reef, afforded a monthly supply of 400 tons of pyrites in 1919, and it is thought that supplies from this source can be increased to 1000 tons. The remaining requirements of the Union may possibly be met by the utilisation of pyrites derived from concentrates produced in the Barberton district; the presence of arsenic, to the extent of about 1 per cent., has hitherto hindered their exploitation.—(*S. Afr. J. Ind., Nov.*, 1920.)

AUSTRALIA.

Yacca Gum in South Australia.—The collection and export of yacca gum was an important industry in Kangaroo Island, South Australia, prior to 1914, but operations were suspended during the early years of the war as the chief market, Germany, was closed. A revival, however, took place in 1916, and in 1919 over 10,000 tons was collected, most of which was exported to Great Britain and the United States. The gum is soluble in alcohol and caustic alkalis, but insoluble in turpentine, linseed oil, benzine, and hydrocarbon solvents generally; it is stated to be serviceable in the manufacture of photographic chemicals, dyestuffs, and linoleum (*cf.* J., 1918, 392 R).—(*U.S. Com. Rep., Nov.* 19, 1920.)

NEW ZEALAND.

Mining and Minerals in 1919.—The Mines Statement for 1919, by the New Zealand Minister of Mines records that legislation will shortly be introduced to revive the bonus provisions of the Iron and Steel Industries Act, 1914, and that arrangements are being made to have 20 tons of iron sand from Taranaki and 20 tons of iron ore from Parapara tested in England by a new process in order to determine if it is possible to produce iron on a commercial scale in New Zealand. Since September, 1919, the Government has been negotiating with the British Admiralty with a view to making an arrangement with the British Government for boring and developing mineral oil and other products in New Zealand, but no agreement has yet been made. Unfortunately, petroleum has yet not been found in payable quantity in New Zealand, but the Government is now taking steps to settle definitely whether the oil resources are of commercial value.

During the year 1919 gold to the value of £573,662 was obtained from quartz mines, 286,073 tons of ore being treated; the value from alluvial and dredge mining was £128,111. There was practically no demand for tungsten ore (scheelite) for the English market; the price fell from 68s. to 30s. per unit, and consequently the production was very small—131 tons, compared with 169·5 t. in 1918. The mining of cinnabar and production of mercury were carried out by one company, and 11,175 lb. of metal was produced. The Mines Department is assisting the company to test the lode on its property, and improved returns are looked for in the near future. The quantity of phosphate rock quarried was 4000 t., as against 5000 t. in 1918. The coal output was 1,847,848 t., compared with 2,034,250 t. in 1918, the decrease being due to organised restriction of work by the miners on several fields. The production of kauri gum rose from 2419 t., valued at £157,313, in 1918, to 4128 t., worth £255,812, in 1919. A company with a capital of £200,000 has been formed to produce oil and gum from kauri peat, of which it possesses some

6½ million cb. yds. on its properties. As the yield is estimated to be £1's worth of fine gum per cb. yd. of peat, a large production is anticipated.

UNITED STATES.

Coloured Plasters.—The production of coloured plasters has been made possible by simply mixing dyed wood fibres with gypsum. A series of samples has been made and tested by the U.S. Bureau of Standards.

Charcoal from Walnut Shells.—Experiments made in California appear to have overcome the difficulty attending the retorting or charring of dusty cellulosic materials such as walnut shells. The ground shells are passed through the hot zone of a flame which completely burns off the dust, baffles and lifters ensure adequate mixing, tar is recovered from the exit gases, and the resulting charcoal is quenched as it is discharged from the kiln. The walnut-shell charcoal is used instead of willow charcoal for poultry.

Use of Cyanamide and Superphosphate Mixtures as Fertiliser.—The toxic effects on plant life due to the application of cyanamide mixed with superphosphate are now reported to be caused by the rapid formation of dicyanodiamide. Conversion of cyanamide into dicyanodiamide by moisture is much accelerated in the presence of superphosphate; calcined and basic phosphates exert no action. The use of a dry mixture is of little avail as the soil moisture may bring about the change under certain conditions.

Lime in 1918.—The total quantity of hydrated lime produced in 1918 was 620,216 short tons, valued at $5,342,513, and the total quantity of lime sold amounted to 3,206,016 short tons valued at $26,808,909, an average price of $8·36 per ton. The building trade consumed 28·5 per cent., chemical works absorbed 17·7, and agriculture used 12·2 per cent. of the total production. Imports amounted to 6650 t. and exports to 7191 t.

At least five companies used lignite as fuel, one producer reporting that it compared favourably with other fuels, both in regard to cost and the quality of lime produced. A lignite containing a large percentage of moisture produces a soft-burned lime similar to lime burned with wood. It usually requires about half a ton of lignite to burn a ton of lime. To be used efficiently the kiln should have a fire-box with large grate area and a high arch or combustion chamber; it should also have a taller shaft than usual since the gases in lignite distil off very rapidly and would otherwise burn off on the top of the kiln. After storing lignite a week or two, it will produce only about half the quantity of lime it does when fresh.—(*U.S. Geol. Surv., June* 7, 1920.)

JAPAN.

Opium Production.—The production of opium in Japan has made very great strides during the past few years, as the following official statistics show:—1913, 2196 cwt.; 1914, 2877 cwt.; 1915, 7516 cwt.; 1916, 22,774 cwt.; 1917, 28,792 cwt.; 1918, 10,123 cwt.; 1919, 33,731·5 cwt. During 1919 the poppy was cultivated in thirty Prefectures of which Osaka, Wakamaya, Hojogo, Yamayachi, and Seitana were the chief. The average morphine content of the 1919 crop was 12·68 per cent., which was 3 per cent. lower than that of the crop in 1918.—(*Chem. Ind., Dec.* 15, 1920.)

The Cement Industry.—The Japanese cement industry is in a flourishing condition; the formation of several new companies is announced, and most of the existing companies have extended their activities. The combined paid-up capital of twelve old-established firms increased from £3,200,000 in 1914 to £4,460,000 in 1919, and the price of cement rose from 6s. 1½d. per 400 lb. to more than four times that amount during the same period; similarly, the production increased from 3,625,000 to 6,500,000 barrels, and the exports from 258,000 to 997,000 barrels.—(*Bull. Dept. Tr. and Com.*, Nov. 22, 1920.)

"Koka Seki" Pumice.—"Koka seki" is a variety of pumice stone found only in the Niijima Islands, about 90 miles south of Tokyo. It has long been used as a building material, and on account of its durability, high tensile strength, and resistance to heat (1300° C.), it can be used in boilers and furnaces as well as for lining safes and refrigerators. Its most important use is in the construction of reinforced concrete barges. The concrete is stated to be about 60 per cent. lighter than the ordinary kind, and to be absolutely resistant to seepage, erosion, etc. "Koka seki" has recently been selling in Japan at about 2s. per cb. ft. for blocks and 8d. per cb. ft. for flakes and sand.—(*U. S. Com. Rep., Oct.* 26, 1920.)

FRANCE.

Industrial Notes.—*Coal.*—The high costs of coal and labour, together with shortened hours of work, are responsible for the continuance of the industrial crisis. The economic situation has been seriously affected by the excess of supply over demand, imports having exceeded exports and Allied war stocks having been released. The high cost of coal in particular is a serious handicap, for the price is in France very much higher than in any of the neighbouring countries, and manufacturers are therefore unable to cope with foreign competition. The remedy suggested is not a high tariff wall, but compensatory duties to equalise the production costs to competitors. The decontrol of the coal industry is being considered by the Minister of Public Works and the Coal Commission has been instructed to prepare a scheme to ensure supplies until decontrol is complete. The output of coal in October was 2,250,880 tons, and of lignite 85,585 t., whilst 846,629 t. was produced in the Saar basin. Germany exported 1,814,864 t. during November, of which 1,242,974 t. went to France. Imports of American coal continue to increase; in January, 1920, 20,000 t. was imported at $30–32 per ton, and in November, 1920, 700,000 t. at $15–16 per ton.

Chemical Industry.—The formation of large chemical trusts in the United States, in Great Britain, and, to some extent, in France, is being criticised on the ground that such combinations tend to develop bureaucratic methods and thus lead to inefficiency. The critics would prefer a system of agreements between producers under which each would specialise in certain products and supply prescribed areas. Such a system, they say, leaves to each partner his own responsibilities and interests, but allows him to reap the advantages accruing from concerted action.

Great progress is being made by the Société des Matières Colorantes et Produits Chimiques de St. Denis, which extended its works in 1919 with a view to producing all the raw materials and intermediates required in dyestuff manufacture. In June, 1920, it was producing coal-tar intermediates and dyes at the rate of 135 and 150 tons a month, respectively, and as soon as certain extensions are completed, these figures will be more than trebled, thus allowing an ample margin for export.

The Société de la Grande Paroisse intends to erect at Montereau a synthetic nitrogen plant (Claude process) with a daily capacity of five tons of liquid ammonia, and the Société Norvègienne de l'Azole is to extend its nitrogen works at Soulom.

Metallurgy.—The demand for metallurgical products is very small in view of the expected decline in prices. It is unlikely, however, that prices will fall to any extent until the large stocks of foreign coal bought at high prices have been liquidated. The reported agreement between French, Belgian, and Luxembourg producers of cast iron with a view to stabilising prices has not been ratified.

GENERAL.

Chaulmoogra Oil.—In a recent number of the *Journal of Tropical Medicine and Hygiene*, Dr. T. A. Henry, Director of the Wellcome Chemical Research Laboratories, describes some recent developments in the use of chaulmoogra oil in the treatment of leprosy. It appears that Dr. J. McDonald and Professor Dean, working in Hawaii, have obtained promising results by the treatment of this disease with the ethyl esters of the fatty acids peculiar to chaulmoogra oil. These acids were thoroughly investigated by Dr. F. B. Power and his collaborators some years ago and shown to differ from ordinary fatty acids in constitution and in being optically active.

Sir L. Rogers and others working in India have improved on the old method of administering chaulmoogra oil itself by using the sodium salts of fractions of the fatty acids for injection and also for oral administration, and the method in use in Hawaii appears to be a further development of this, by the use of fractionated ethyl esters in place of the sodium salts. Mechanically, at all events, the esters are better than the salts for injection. Rogers and his collaborators have recently found that they can get equally good results with the sodium salts of fatty acids from other oils than chaulmoogra, *e.g.*, gynocardia oil, and it therefore becomes a question whether the efficacy of certain oils as remedies for leprosy, and possibly also for tuberculosis, is not common to many oils and due, as has already been suggested, to their solvent power on the waxy external coating of acid-fast bacilli. Against this view is the evidence brought forward by Walker and Sweeney in California that the action of the chaulmoogra-oil fatty acids is specific against the leprosy bacillus *in vitro*.

Agricultural Industries in Jamaica.—According to a recent report of the Department of Agriculture, Jamaica, the period June, 1919, to June, 1920, marked the greatest industrial revival which the island has experienced during the past century. The recorded exports for 1919 increased by over 100 per cent. in value over those of the previous year, and there appears to be every prospect of stable markets for all the chief products of the various industries. Although Jamaica now produces many goods that were formerly imported, much still remains to be done, and it has been suggested that the following industries, *inter alia*, could be profitably initiated:—Condensed milk, cement, glass bottles, rope and string, and leather.

Marked progress was made in the sugar industry, exports being 38,000 tons, valued at £1,333,000, and £225,000 inclusive of rum. This record is expected to be much exceeded in 1920. The banana industry made a welcome recovery in the absence of hurricanes, and there were exported 10 million bunches of bananas and 20,000 boxes of evaporated bananas. The coconut crop showed a progressive recovery from the effects of the cyclone in 1917, with an export of over 24 million nuts and nearly 700 tons of copra. At no period of its history has Jamaica been so free from coconut diseases as at the present time, and the high value of the products is an incentive to increased cultivation. Logwood and its extracts have, contrary to expectation, enjoyed a revival of prosperity under post-war conditions, and an improvement of £60,000 over last year's values was recorded. Logwood is in strong demand at high prices, and all the local factories are working at full capacity. Orange oil realised good prices, and crop values are nearly double those of the previous year. Cacao had a good year, with an output value 90 per cent. greater than in 1919. Cotton cultivation has received some attention, and a small planting of Sea Island cotton resulted in a handsome profit to the grower. Pimento was in good demand abroad, the exports being valued at £184,000. Experiments on the production of pimento oil and its commercial conversion into vanillin are now being carried out at the Government Laboratory; if these are successful, Jamaica should command the world's markets for vanillin.

The production of sisal fibre is becoming an important new industry. The Government has already embarked on a large sisal enterprise at Lititz, where it has been shown that a minimum output of 1000 lb. of fibre per acre in the first cutting can be relied upon. This fibre has been thoroughly investigated in London, and offers have been received to buy all that can be produced at a very remunerative price. It is estimated that fibre to the value of £400,000 could be produced annually on land which has hitherto been comparatively unproductive. Hides were in good demand. When the tick question has been solved by the compulsory dipping regulations which will shortly come into force, a decided appreciation in the value of the hides produced in Jamacia should result.

Pimento-leaf Oil in Jamaica.—Investigations at the Government Laboratory of Jamaica have shown that the pimento leaf yields about 1·8 per cent. of eugenol, from which iso-eugenol and vanillin can be obtained. Iso-eugenol can also be obtained by the appropriate fermentation of pimento leaves. Eugenol could be used in the manufacture of vanillin and, as it is a strong antiseptic, it would be a suitable constituent of dental and toilet preparations. Jamaica could produce 100,000 lb. of pimento-leaf oil per annum from waste materials were a market available.—(*U.S. Com. Rep., Nov.* 1, 1920.)

Borates (1913—1919). (*Imperial Mineral Resources Bureau. Pp.* 24. *Price* 9*d*.).—The natural borates of industrial value include, in the order of importance, (1) ulexite (hydrated borate of sodium and calcium), (2) colemanite (hydrated calcium borate), (3) boracite or Turkish pandermite (borate and chloride of magnesium), (4) sassolite (native boric acid occurring chiefly in solution), and (5) borax (hydrated sodium borate).

As is well known, borax is used for many purposes, *e.g.*, as a flux in brazing and brass manufacture, as a constituent of pottery glazes and enamels, and as a glaze for paper and linen. It is employed in the tanning, glue, glass, and soap industries, and the borates of manganese and lead are used as drying agents in the paint trade. The perborates of calcium and sodium find application as a source of pure hydrogen peroxide, and hence also in the production of some modern bleaching powders.

Boron in the form of a suboxide is used to remove oxygen from copper just before casting, the conductivity and density of the metal being thereby greatly improved. It is also used in the manufacture of strong aluminium bronzes, in hardening and strengthening aluminium castings, and in the manufacture of nickel castings. Experiments conducted in France during the war indicated that remarkably strong and tough steels can be produced with the aid of ferro-boron. Another use of boron is as a voltage regulator in incandescent lamps, arc lamps, and other devices on series circuits.

The United States is now the great producer of crude borates, the production during the last three years amounting to over 80,000 metric tons per year. No analysis of the crude material is given, so that it is impossible to gain any idea as to the relative importance of the producing countries in terms of refined borax. The deposits are situated throughout the Great Basin region, and in particular in the counties of Inyo, Kern, and San Bernardino in California and in the adjacent part of south-west Nevada. The borates are found in marshes and dried-up lakes, and are of a secondary character, being derived from beds of colemanite in the Tertiary lake sediments of the surrounding hills. Chile, Peru, and Bolivia rank next in order of importance as producers of borates. The western range of the Andes of South America contains many lofty volcanoes recently extinct, and around the base of these mountains there exist borax lakes sufficiently numerous to supply the world for many centuries to come, although but few of them have yet been developed. All of these deposits are owned and worked by a British company, Borax Consolidated, Ltd. No part of the British Empire produces borates at the present time. Our imports of calcium borate, borax, and boracite during 1919 amounted to 325,826 cwt., valued at £387,169, of which 13,416 cwt., worth £25,845, was exported.

The report contains detailed statistics concerning the foreign trade in borax and boric acid of the various portions of the British Empire, and interesting notes on the character of the world's deposits. It is to be regretted, however, that no statistics are given showing the production of refined borax in the chief producing countries.

The Petroleum Industry of Mexico.—Although the United States contributes about two-thirds of the oil supply of the world, 40 per cent. of the producing fields have become exhausted, and it is estimated that the oil reserves will be depleted within the next twenty-five years. The United States is at present an importer of oil, and this condition is bound to continue and to become more and more apparent. Mexico, ranking second as an oil producer, offers scope and encouragement not only to the American oil interests, but also to the Eastern hemisphere. Mexican production has increased threefold in the last seven years, as the following table shows:—

Year.	*Mexico.*	*U.S.*	*World.*
1913	25,902,439	248,446,230	384,667,550
1914	21,188,427	265,762,535	399,667,168
1915	32,910,508	281,104,104	426,370,894
1916	39,817,402	300,767,158	459,433,319
1917	55,292,770	335,315,303	505,362,367
1918	63,828,327	355,927,716	514,729,354
1919	87,359,533	377,719,000	

(The production is given in barrels of 42 galls. capacity)

Potential and Actual Production.—The potential production, *i.e.*, the amount that could be produced were each well allowed to flow without restraint, of Mexico during 1918 was 547 million barrels. Only about 12 per cent. of the potential capacity of the wells is being actually produced at the moment. This is partly due to lack of transport both for oil and materials, partly to lack of storage facilities, and partly to the political situation; moreover, new legislation has tended to check development.

Comparison of Mexican and American Wells.—The oldest wells in America are in the Appalachian field, and number about 100,000. The average production is ⅔ barrel per well per day; in the Californian field the average is 30 brls. daily per well, whilst there are 25 wells in Mexico which could produce freely 24,000 brls. per day per well.

New Mexican Fields.—The zone of potential production in the Gulf Coast States is estimated at 80 million acres, in the Pacific Coast at 50 million, and in Lower California at 18 million acres, a total, in all, of 230,000 square miles—of which only 6½ million acres have been investigated. The actual producing fields cover 800 sq. miles. Geologists predict that a paraffin base oil may be looked for, or, at any rate, an oil of lower asphalt content than that produced at present.

The Salt Water Menace.—The Terpetate, Huasteca and Casiano fields have been seriously invaded by salt water. In November, 1919, the Casiano 7, producing 25,000 barrels per day, turned to salt water. This phenomenon will probably stimulate the exploration of the southern fields.

Pipe Lines and Transport.—Production is greatly restricted by insufficient transport. Pipe lines of total carrying capacity of 300,000 barrels per day are under construction and projected. Some of the very heavy and viscous oils cannot be moved in lines, tank cars are necessary, and even then heating facilities must be provided. The Tampico Panuco railroad is the most important common carrier in the oil region.

Storage and Refineries.—A great surplus of crude petroleum is stored in earthen reservoirs, awaiting improvement in transport facilities. In January, 1919, the tankage was 49 million brls., mainly steel, but to a limited extent concrete. There is a great need for refineries, and the Mexican Government proposes to encourage their establishment by the grant of concessions and franchise. There are four plants at Tampico, one each in Tuxpam, Vera Cruz and Minatitlam, with a total capacity of 100,000 brls. per day. About 20 per cent. of the oil exported is refined. New refineries are being contemplated and erected at Panuco, Tecomate, Tampico, and Mexico City.

Statistics for 1920.—For the first six months of the current year the oil exports from Mexico reached 60 million brls., a 72 per cent. increase over the corresponding period of 1919; the United States took 71 per cent. of the total production, South America 8 per cent. and Great Britain 4 per cent. The consumption of oil in Mexico itself amounted to 4 per cent. of the production.—(*Report of the Bureau of Foreign and Domestic Commerce, U.S.A.*)

Sesame Seed in Mexico.—The production of sesame seed in Mexico is capable of great expansion, as the climate of the chief producing states, Michoacan, Guerrero, Marelos, and Vera Cruz, is admirably suited to the crop, and large areas of untilled land are available. The white and brown varieties of sesame grown in the country have an oil content officially estimated at 50 per cent., but although the former is stated to be richer in oil, the latter grows more rapidly and produces more crops in a given period of time. The methods employed for separating the oil are said to be more modern than those used for olive oil in Spain and Italy. The first-grade oil is almost odourless and is used as a substitute for olive oil as well as in the manufacture of oleomargarine and in the adulteration of other edible oils. The inferior grades, which are usually rancid, are used for soapmaking, as a combustible, and as a basis for perfumes. The cake remaining after extraction is similar to cottonseed cake in value and is used as a cattle food. The leaves of the plant have medicinal properties.—(*U.S. Com. Rep., Oct.* 30, 1920.)

The Asbestos Industry in Russia.—The Russian asbestos industry suffered greatly during the war, and the production fell from about 24,500 long tons in 1913 to 4000 t. in 1919. The industry is situated in the Urals, and prior to the war 70 per cent. of the production was taken by Great Britain, Germany and Austria. Great difficulty is being encountered in the work, especially with labour, owing chiefly to the seasonal character of the operations. The labour costs for 1920 are estimated at over 52 million roubles, a much higher sum than in previous years and more than double the total capital invested in the industry.—(*Gummi-Zeitung, Oct.* 29, 1920.)

The Belgian Iron and Steel Industry.—The present position of the Belgian iron and steel industry, as compared with that in 1913, is shown by the following statistics:—On October 1, 1913, 50 out of 58 blast furnaces were alight and the daily production of all pig iron was 7272 tons; on the same date in 1920, 21 out of 51 blast furnaces were alight, 30 being under reconstruction or not in use, and the daily production of pig iron was 3354 tons. Since July 1, 1920, the average daily production of pig iron for steel manufacture has increased by 22 per cent., that of pig iron for castings has increased by 100 per cent., and four more blast furnaces have been blown in.—(*Bd. of Trade J., Dec.* 2, 1920.)

Lectures on Glass.—The British Lampblown Scientific Glassware Manufacturers' Association has arranged a series of lectures in connexion with the Lampblown Glass Industry, to be held at the Northampton Polytechnic Institute, Clerkenwell, E.C. 1, on Wednesdays at 7.30 p.m. from January 5 to March 23, inclusive. Prof. W. E. S. Turner will lecture on Glass Tubing (Jan. 26); Mr. English on Glass Manipulation at the Bench (Jan. 19), Mechanical Devices (Feb. 2), Graduation of Apparatus (Feb. 9); Mr. Higgins on Thermometry and Thermometers (Feb. 16, 23, Mar. 2); Mr. Stott on Volumetric Glassware (Mar. 9, 16), and Mr. Davis on Chemical Glassware (Mar. 23). The fee for non-members of the Association is 10s. 6d. for the course, or 2s. 6d. per lecture. Further information may be obtained from the Secretary of the Association, Mr. H. W. Ashfield, at 2/3, Duke Street, St. James, S.W. 1.

PERSONALIA.

The honour of knighthood has been conferred upon Prof. James Walker, professor of chemistry in the University of Edinburgh.

Dr. Harriette Chick has been awarded the Mickle Fellowship of the University of London for her work on diseases due to defective nutrition.

Mr. A. W. Ambrose has succeeded Mr. J. O. Lewis as chief petroleum-technologist to the United States Bureau of Mines.

Dr. C. J. Witt, assistant professor of analytical chemistry in the University of Pittsburgh, has become chief research chemist to the Portland Cement Association, U.S.A.

Dr. C. O. Johns, head of the colour laboratory of the Bureau of Chemistry, U.S. Department of Agriculture, has been appointed director of a new department of general research of the Standard Oil Company, New Jersey.

Dr. W. H. Walker has resigned from the directorship of the Division of Industrial Co-operation and Research of the Massachusetts Institute of Technology, and Mr. C. L. Norton, professor of industrial physics at the Institute, has been appointed in his stead.

Prof. Fr. Dolezalek, founder and director of the Physical and Electrochemical Institute in the Technical "Hochschule" of Berlin, died on December 10, aged forty-eight.

We regret to announce the death on December 1 last of Mr. Robert Tervet, of Leyton, Essex, an original member of this Society, who contributed papers on destructive distillation and on the production of ammonia from coke, showing the possibility of obtaining a yield of ammonia equivalent to 57 lb. of sulphate of ammonia per ton of coal by passing hydrogen over the incandescent coke remaining after carbonisation, the hydrogen combining with the residual nitrogen of the coke.

PARLIAMENTARY NEWS.

HOUSE OF LORDS.

In the House of Lords on December 23, Lord Cawley gave notice of his intention to move next session for a Committee of Inquiry into the circumstances attending the formation of British Dyestuffs Corporation, Ltd., and into its connexion with the Government.

HOUSE OF COMMONS.

Exports of Cement.

Replying to Lieut.-Col. Croft, Sir R. Horne said that there was now a shortage of cement in this country, but the output was improving. The exports for the first eleven months of 1920 represented about 23 per cent. of the output, which was, roughly, the pre-war proportion, and consisted of 246,184 tons (£1,338,000) sent to foreign countries and 318,939 t. (£2,022,000) sent to British Possessions.—(Dec. 20.)

Substitutes for Salvarsan and Neo-Salvarsan.

In answer to Mr. Waterson, Dr. Addison said that the following substitutes for salvarsan and neo-salvarsan had been approved:—Kharsivan, neo-kharsivan, arsenobillon, novarsenobillon, diarsenol, neo-diarsenol, galyl, and salvarsan (manufactured by an English firm). These drugs were all officially tested for toxicity before being placed on sale, and there was good reason to believe that, with the exception of galyl, they all corresponded in general chemical constitution to the analogous German preparations.—(Dec. 20.)

Metalliferous Mines (Legislation).

Mr. Bridgeman, answering Mr. Cape, said that a Metalliferous Mines Bill was being prepared, but it was improbable that it could be introduced next session.—(Dec. 21).

Coal Output.

In a written answer to Mr. Purchase, Mr. Bridgeman stated that the coal output during the week ended November 20 (the first full week since the coal strike) and during the three following weeks was 5,210,700, 5,176,500, 5,176,200, and 5,205,400 tons respectively. Weekly figures for the corresponding pre-war period were not available. Until the figures for the last week of the test period were obtained it was impossible to state how the wages scale would be affected. The present position of the industry did not warrant any hopes of cheaper home coal.—(Dec. 21).

Wet Carbonising, Ltd.

Mr. Bonar Law, in a written answer to Mr. Bottomley, stated that Wet Carbonising, Ltd., guaranteed a contract by its subsidiary, Lochar Ltd., for the purchase of the Ironhurst Peat Fuel Factory, near Dumfries, from the Government for £370,000. These companies had been unable to raise the necessary capital, and Wet Carbonising, Ltd., would be responsible to the Government for any deficit that might ensue if the factory were sold elsewhere for less than the guaranteed price.—(Dec. 22.)

The Royal Assent has been signified to the British Empire Exhibition (Guarantee) Act, 1920, to the Women and Young Persons (Employment in Lead Processes) Act, 1920, and to the Employment of Women, Young Persons and Children Act, 1920. The Electricity (Supply) (No. 2) Bill was withdrawn on December 20.

Parliament has been prorogued to February 15, 1921.

GOVERNMENT ORDERS AND NOTICES.

Import and Export Restrictions, etc.—The importation of hops is prohibited, save under licence or for transhipment, as from December 28, 1920.

All licences for the export of whisky granted prior to January 1, 1921, will be revoked as from February 1 next.

The following articles have been removed from Lists A and B of prohibited exports, as from December 30, 1920:—Potash, muriate and sulphate, crude manurial potash salts, and mixtures containing any of these substances; potassium permanganate; sugar, beet and cane.

The Commissioners of Custom and Excise have issued alterations in the Import and Export List, and the revised List will be published shortly. The *Board of Trade Journal* for January 6 contains a revised list of the foreign countries and British Possessions for use in the Monthly and Annual Trade Returns.

Importation of Dyes under the Dyestuffs (Import Regulation) Act, 1920.—The Board of Trade announces that applications for import licences required for any goods covered by the Act should be addressed to the Secretary, Dyestuffs Advisory Licensing Committee, Danlee Buildings, 53, Spring Gardens, Manchester. Applicants must supply full information concerning the wares they wish to import.

Appointments under the Gas Regulation Act, 1920.—The Board of Trade has appointed Sir R. T. Glazebrook to be Chief Gas Examiner, and Messrs. O. V. Boys, J. S. Haldane, and W. J. A. Butterfield to be Gas Referees. Mr. H. C. Honey is appointed Director of Gas Administration in the Power Transport and Economic Department, Board of Trade Offices, Great George Street, S.W. 1. A committee consisting of Sir W. Pearce (chairman), Dr. T. Carnwath, Mr. W. D. Gibb, and Dr. T. Gray, has been set up to inquire into the necessity or desirability of prescribing a limit to the carbon-monoxide content of gas used for domestic purposes; and also a committee, consisting of Mr. J. H. Gray (chairman), Mr. W. J. Butterfield, and Dr. C. H. Lander, with similar terms of reference, but relating to incombustible constituents.

Proposed New Regulations for Chemical Works.—The Home Secretary has issued a draft of the new regulations he proposes to make to supersede those made in 1908 for the manufacture of nitro and amido derivatives of benzene and those made in 1913 for the manufacture of chromate and bichromate of sodium and potassium. The new regulations are divided into those which are applicable to all chemical works, as defined in the schedule, and those relating to works in which there are special dangers. The manufactures of certain lead compounds, already dealt with in special codes, are excluded, and also processes of bleaching, dyeing, mercerising, tanning, brewing, alcohol distillation, and all experimental processes. Copies of the draft regulations may be obtained from the Factory Department, Home Office, S.W. 1, and objections must be lodged within 30 days of December 24.

Orders Cancelled.—The Oil and Fat Compound (Licensing of Manufacturers and Requisition) Order, 1918, the Seeds, Oils and Fats Order, 1919, and the Cattle Cakes and Meals (Licensing) Order, 1919, have been revoked, as from December 23.

Increased Wages in the Chemical Industry.—The Industrial Court has awarded to plain time-workers increases in wages which amount to, in general, 39s. 6d. a week plus 12½ per cent. on total earnings over the pre-war rates, and equivalent advances to pieceworkers.

OFFICIAL TRADE INTELLIGENCE.

(From the Board of Trade Journal for December 23 and 30, and January 6.)

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W. 1, from firms, agents or individuals who desire to represent U.K. manufacturers or exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department and quoting the specific reference number:—

Locality of Firm or Agent.	Materials.	Reference Number.
Australia	Chemicals, oils, grease	891
„	Crockery, glassware	3
Canada	Copper and brass rods, tubes and sheets, tinplate	858
„	Tiles, fire-brick, glass, marble, slate	*
„	Soda ash	†
Hong Kong ..	Chemicals	865
New Zealand ..	Chemicals, dyes, paper	7
South Africa ..	Solid-drawn hard copper tubing..	860
„ ..	Antifriction grease, paint, glass, wrapping paper	861
Belgium	Glue, glass-paper, varnish ..	869
„	Bichromate and permanganate of potash, sodium bicarbonate, paraffin wax, petroleum jelly ..	870
„	Chemical and pharmaceutical products, materials for the manufacture of chocolate and perfumery..	11
Bulgaria	Articles in demand include oils, grease, emery, iron, cement, mineral oils, copper sulphate, paper, window glass, dyes, colours, chemicals, lead, copper, tinplate, and wire	
France	Chemicals, cattle foods, fertilisers	875
Greece	Glass and china ware, leather, dyes, and photographic goods..	13a
Italy	Chemical and pharmaceutical products	879
„	Tinplate, steel and iron tubes ..	14
Latvia	Copper tubing	15
Switzerland & Italy	Heavy and pharmaceutical chemicals, oils, fats	883
Morocco	China and glass ware	22a
China	Scientific supplies	898
Japan	Magnesium, aluminium, lead, tin, tinplate, steel sheets, caustic soda, soda ash, carbolic acid, fertilisers..	899
Brazil	Tinplate, tin, metals, chemical and pharmaceutical products, cement, paper	28
Chile	Glassware, pottery, explosives, paper	30
Mexico	Drugs, perfumes, leather (catalogues of)	887
Peru, Bolivia, Ecuador	Chocolate	888
United States ..	Antimony	885
„ ..	Metals	25
„ ..	Glassware	27

* The Canadian Government Trade Commissioner, 73, Basinghall Street, London, E.C. 2.

† The High Commissioner for Canada, 19, Victoria Street, London, S.W. 1.

Market Sought.—A firm in Japan wishes to get into touch with U.K. importers of camphor, menthol, vegetable and fish oils, starch, ground nuts, and isinglass. [899]

TARIFF. CUSTOMS. EXCISE.

Australia.—The embargo on the export of goods to Germany, Austria, Hungary, Turkey and Bulgaria has been removed.

Austria.—Customs duties when paid in bank notes have to be paid at 40 times the rates prescribed by the Tariff as from December 1.

Belgium.—Export licences are no longer required for steel ingots, etc., fire-bricks, chemical manures (with certain exceptions), certain oil-seeds, bone and bone powder, newsprint paper, and natural phosphate.

British Guiana.—The prohibition of the import of dyes and dyestuffs not manufactured within the British Empire has been temporarily withdrawn.

British Honduras.—The new customs tariff came into force on October 12, 1920.

Among the articles exempted from duty are coconuts, cohune nuts, certain drugs, charcoal, raw rubber, balata, chicle, raw hides and skins, horns, bones, fertilisers, fungicides, insecticides, copra, quinine, sand, slate, scientific apparatus, certain tanning and dying materials, tonca beans, serums, and radium.

The articles admitted duty free under the British Preferential Tariff include explosives (except sporting), tiles, bricks, cement, barbed wire, unskimmed condensed milk, fuel and lubricating oils, newsprint paper, and rock salt.

Canada.—Drawback of 99 per cent. of the duties paid is now allowed on the materials used in the manufacture of margarine.

The customs duty on condensed milk has been increased; and the "luxury" taxes, with certain exceptions, have been repealed.

Colombia.—The export of gold is now permitted.

Costa Rica.—The text of the revised consular regulations of Costa Rica may be seen at the Department, 18, Queen Anne's Gate, S.W. 1.

Denmark.—Export prohibitions have been removed from, *inter alia*, cement, gypsum, prepared hides and skins, leather, old cast iron, fertilisers (except potash compounds), starch, soda, and tar.

Egypt.—The issue for January 6 contains a list of the revised tariff valuations for use in assessing the duties on imported non-ferrous metals.

Germany.—The detailed list of "controlled" imports may be seen at the Department, 18, Queen Anne's Gate, S.W. 1.

The import of waste paper, paper clippings, and paper, pasteboard and pasteboard wares suitable only for re-pulping is allowed without licence.

Among the articles for which no import licence is required are raw cocoa, rubber, gutta-percha, balata, certain feeding stuffs, asbestos, and some glass wares.

No export licence is required for ambergris, night tapers of waxed thread, natural spring salts, raw silk, wax cloth, emery cloth, carbons for arc lamps, certain wares of talc, asphalt and glass, spun silver and aluminium, and threads of common metals.

Italy.—The surcharge on customs duties when paid in paper money is fixed at 200 per cent. as from December 15, 1920.

Export licences are no longer required for, *inter alia*, bichromates of soda and potash, dinitrotoluol, milk sugar, certain medicines, tin, aluminium and zinc ash. Export licences are now required for linseed and maize cakes, pyrites, etc.

Lithuania.—The export duty on linseed has been increased from 25 to 30 marks per pound.

Luxemburg.—The export is now permitted of tin, pottery, earthenware, ceramic wares, india-rubber and india-rubber wares. An import licence is still required for cement, and the import of saccharin is prohibited.

Mexico.—Recent modifications of the customs tariff are set out in the issue for January 6.

The export duty on copper has been removed.

New Zealand (*Samoa*).—The customs tariff is set out in the issue for January 6.

Northern Rhodesia.—The customs and excise duties on spirits have been amended as from October 16, 1920.

The importation of certain dyes and dyestuffs not manufactured within the British Empire is prohibited.

St. Vincent.—The prohibition of the export of hides and skins has been revoked, and that on the import of certain dyes has been temporarily suspended.

Serb-Croat-Slovene State.—The period during which goods may remain in customs warehouses has been reduced to five days, and outside the warehouse to ten days, after which the goods will be sold.

Sweden.—Among the articles still subject to export licence are crude phosphate (except apatite), asbestos, asphalt, colours, lard, tallow, margarine, starch, cattle foods, milk powder, yeast, sugar, syrup, glucose, colouring matter, certain hides and leathers, vegetable fibres, certain metals and alloys, mineral oils, vegetable oils (with some exceptions), varnish, putty, caustic potash, potash salts, tin salts, indigo, Chilean nitrate, and animal waste.

Switzerland.—Special export licences are still required for, *inter alia*, cocoa, chocolate, sugar, preserved milk, oil cake, hides, skins, sole leather, charcoal, fibrous materials for the manufacture of paper, rubber, gutta-percha, porcelain insulators, certain kinds of glass, certain ores, metals and metal scraps, alkaloids, saccharin, certain chemicals, pitch, sulphur, turpentine, tar, caustic potash and soda, dyes, colours, colour varnish, and mineral oils.

Tripolitania and Cyrenaica.—The import duty on spirits has been increased.

Tunis.—A special tax of 2 fr. per metric ton is payable on exports of phosphates, in addition to the duty of 50 cts. per metric ton.

TRADE NOTES.

BRITISH.

Cyprus in 1919–20.—Cyprus is essentially an agricultural country, the chief products being fruit, cotton, sumac, and castor oil. Good results have been obtained in the cultivation of beetroot, but experimental plots of sugar-cane were a failure. Wine-making is, however, very prosperous. The forests constitute very valuable resources, and experiments on the distillation of forest produce for the production of pyroligneous acid have been continued. Difficulties in obtaining supplies have hindered mining operations, but these have been overcome and preparations for working on a large scale have begun. The Cyprus Mines Corporation has extracted 820 tons of cupriferous iron pyrites. A local syndicate, which acquired the property of the Cyprian Mining Co., was actively engaged in mining asbestos at Amiandos. Gypsum and umber were also produced.

The imports were valued at £1,525,427 (£1,013,582 in 1918), and were chiefly of British origin (81·2 per cent.). Exports amounting to £1,371,580 (510,235 increase) were directed mainly to British possessions (£664,424) and the United Kingdom (£313,455). The export of raw umber increased from 53 tons to 2785 tons, and the trade is rapidly increasing; the United States took 1254 t. of umber, Italy 986 t., and the United Kingdom 335 t.—(*Col. Rep.-Ann.*, *No.* 1046, *Nov.*, 1920.)

FOREIGN.

Soda Prices in Germany.—The Soda Syndicate has reduced the prices of soda products by 5 to 10 per cent.—(*Chem. Ind.*, *Dec.* 8, 1920.)

Japanese Trade in Caustic Potash.—The annual prewar requirement of Japan in caustic potash was about 11,160 long tons, half of which was supplied by home producers, and the rest mainly by England and the United States. The cessation of all imports during the war led to a great development of the home industry, and at the present time the annual production is about 13,400 t., though 22,000 t. might be produced by effecting improvements in manufacture. In consequence of speculative buying the home market is flooded with supplies, and manufacturers are asking for a protective duty; but it is unlikely that this would lead to improvement so long as the raw material used remains so poor.—(*Chem. Ind., Dec.* 8, 1920.)

Peruvian Exports of Cochineal.—Ayacucho and Huanuco are the chief cochineal-producing districts of Peru. The production, which before the war was bought by German houses, is now practically all being sold to the United States. The total export in 1917 was 22,193 kg., of which the United States took 5385 kg., and Great Britain 6672 kg.; in 1918 the former country took 33,165 kg. Cochineal is exported to the United States and to Europe through the port of Callao.—(*Rev. Prod. Chim., Nov.* 15, 1920.)

REPORT.

Report of the Lubricants and Lubrication Inquiry Committee. *Department of Scientific and Industrial Research Advisory Council. Pp.* 126. *London: H.M. Stationery Office.* 1920. *Price* 2*s.* 6*d.*

Before the war the annual expenditure on lubricants in this country was six million pounds, and it was estimated that a saving of one to two million pounds could be effected if a systematic investigation on the subject was instituted and the results were made freely accessible to the public. The Advisory Council thereupon decided to set up a Lubricants Committee with the following reference:—"To prepare a memorandum on the field for research containing an analysis of the problems involved, together with a suggested scheme of research which would be likely to lead to valuable results." The committee was presided over by Mr. S. B. Donkin, and contained such well-known authorities as Archbutt, Boys, Deeley, Donnan, Sir C. Parsons, and Lord Rayleigh. A special sub-committee has compiled an exhaustive bibliography of the chemical, physical, and engineering aspects of lubrication which will be published shortly. A considerable amount of research is detailed in the report under notice, notably on the quality of "oiliness," which has been attributed to lubricating oils by so many workers. The National Physical Laboratory has, in particular, been active in the prosecution of these inquiries, which, however, have not yet been brought to a conclusion. Certain material and special aspects of lubrication were brought to the notice of the committee and have necessitated individual investigations and reports which in two cases (Cutting Lubricants and Solid Lubricants) have been issued to the public.

Of the research work carried out at Teddington may be mentioned (*a*) Tests with the Lanchester worm gear, including a variety of mineral, animal, and vegetable oils with and without the addition of graphite and "oildag"; (*b*) the effect of pressure on viscosity; (*c*) determination of the physical constants of oily and non-oily liquids; (*d*) special methods for the determination of viscosity of oils under pressure in bearings (Boys and Parsons); (*e*) Deeley's oil-testing apparatus; and (*f*) the cup and ball viscosimeter. A series of recommendations for future research is tabulated from chemical, physical, and engineering points of view.

Among the appendices may be noted Faust's paper on viscosity at high pressure, a series of researches by Hyde on the Lanchester gear with a variety of lubricants, papers by Parsons and Boys, Deeley and Thomson on viscosity determination, and notes on "oildag."

REVIEWS.

THE ART OF TECHNICAL WRITING.

Technical Writing. *By* T. A. Rickard. *Pp. iv.*+178. (*New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.* 1920.) *Price* 8*s. net.*

The number of books on English composition is legion; among the latest and best is the "Art of Writing," by Sir Arthur Quiller-Couch. But there is still room for a book on the art of writing the literature of science, and particularly the art of putting together communications intended for the pages of scientific and technical journals. It may be alleged that this is literature of no very high order. Elia would possibly have classed books on technology as among books that were no books. But Lamb lived in an unscientific age. Other times, other views. We live in an age of science, and science needs the proper expression of its message as much as any other branch of intellectual activity. "Science and literature," said Huxley, "are not two things, but two sides of the same thing." But, of course, the literature we class as belles-lettres—the literature of rhetoric, poetry, fiction, philology—is characterised by other attributes than those which distinguish the literature of science. There should be no occasion for passion or the play of emotion in a purely scientific disquisition. Thoughts that breathe are to be welcomed, but words that burn are not, and purple patches are out of place. But the fundamental principles of the art of literary expression are common to every branch of literature, and that of science, whether pure or applied, needs them no less than any other.

Men of science, as a class, are not infrequently reproached by humanists for their apparent disregard in their written work of all literary form. "The man of science," said Sir James Barrie, "appears to be the only man who has something to say, just now—and the only man who does not know how to say it." The generalisation is, of course, too sweeping, but every editor of a scientific journal will be ready to admit that there is substantial ground for its partial truth. The author of the book before us, at least, has no doubt of the fact as regards the technologist, and especially the engineer, who, he finds, "does bungle language deplorably. He makes a fetish of efficiency, yet he shows no regard for the effective use of one of his most important tools—the pen; he believes devoutly in accuracy, yet he employs a weapon of precision as carelessly as a small boy handles a gun." But it is not only the engineer who is thus at fault. Technical students as a class are equally to blame. This, to judge from the authorities the author cites, is widely recognised in America. Its cause, in the opinion of the Senate of the University of California, whch appears to have gravely considered the matter, is mainly due "to the unedifying influence of myriad examples of poor English" in the local press. The newspapers the student reads tend to spoil his taste for good English. In addition, he is affected by "a certain public prejudice against correctness of expression," presumably fostered by the local press, which in later life, when he is in "daily contact with illiterate men, inclines him to careless speech and slovenly writing." "The uneducated are inclined to resent any speech more polished than their own."

It is not for us to criticise a finding thus deliberately reached. American journalism, no doubt, has much to answer for. As a rule, its literary quality is not high, although all editors would not concur with the Denver journalist, quoted by our author, who maintained that literary form is "a mere frill," and that the main business is "to get there"—no matter how clumsily.

Examples of solecisms in the American press are quoted that would disgrace a schoolboy. "Our grandfathers used to read the Bible daily; we read the daily newspaper." "The time given to the piffle of the press is lamentable."

But why behold we the mote that is in our brother's eye, but consider not the beam that is in our own eye? This book, although based upon lectures delivered to American students, and primarily addressed to an American public, contains truths which we on this side of the Atlantic may well lay to heart. Journalese is not confined to the United States. We, too, have newspapers which as regards their literary quality not only follow but even seek to better the example of the Denver editor. It may be that their influence on the character of technical writing is inconsiderable, but the daily reading of "piffle" blunts our appreciation of good English and insensibly lowers our standard of excellence. Style can only be absorbed subconsciously by continued contact with the best authors.

Mr. Rickard's criticism, like all useful criticism, is constructive. If he points out a fault he shows how it should be amended. He enunciates rules and illustrates their application. It is remarkable how much he manages to pack into his 178 small octavo pages. He recognises that instruction by precept is long; by example, short and effectual. Considerations of space preclude any detailed attempt to deal even with the general principles he inculcates, but it may be of use to give a short summary of his teaching. Much of it, at first sight, seems almost axiomatic and so obvious that it hardly needs to be stated. But so are the Ten Commandments, yet it is found desirable to repeat them at least once a week. Trite as are the rules of good writing, many of them are more constantly honoured in the breach than in the observance.

Mr. Rickard's golden rule is: *Remember the reader.* Our first aim should be to be understood. Technical writing is the precise expression of special knowledge. We are enjoined to be natural; it is the key-note of good writing, as of good manners. The skilful use of the pen, *pace* Dogberry, is not a gift of nature. To write naturally you must exercise the faculty of writing until it becomes flexible and strong. Good writing depends not so much upon a large vocabulary as upon the choice of words. The dominant fault of the incapable writer is the employment of too many words. Verbosity is a sign of carelessness or of lack of time for proper time. A conscientious author has been known to apologise for the length of his book, like Pliny for the length of his letter, because he had not time to make it shorter. Don't be tempted into the use of high-sounding terms that may serve to cover ignorance. "I have often observed," said Macaulay, "that a fine Greek compound is an excellent substitute for a reason." Greek terms, like razors, are not to be flourished recklessly. Do not use words of classical origin unless you know their meaning and have some knowledge of their etymology. Clearness of statement necessitates precision. The technical term is a word of precision, but let precision be proportioned to accuracy. Do not try to be precise in matters that do not admit of accuracy. The technical writer must be sincere; sincerity is the first essential of all good work. Suit the style to the purpose; fitness is the essence of good taste. Discard the trivial words that are constantly at your elbow; brush aside a host of vapid superlatives. "The superlative," said Metternich, "is the mark of fools." For example, the little word "very" can be deleted nine times out of ten; it is an impediment to terse and perspicuous writing. "Very" makes a strong adjective but a weak adverb; if you employ "very" infrequently, you will find it very useful on occasion. The secret of a vigorous style is the rejection of the superfluous word, but do not hesitate to repeat a word in order to make yourself clear. Perspicuity is the better part of elegance. A doubtful meaning is worse than a grammatical error. Good writing calls for care—persistent care; it calls for a literary conscience that refuses to be satisfied with unfinished work. As the Latin tag has it: *Sæpe stylum vertas.*

These aphorisms, culled from various sections of this book, and largely in the author's own words, will serve to show the character of his work. It deserves to be read, marked, and learned by all who write for the technical press. We may not always agree with his judgments. There are no final or absolute standards in the art of writing, and even the greatest masters of prose may sometimes, like Homer, be thought to nod. But Mr. Rickard has at least the courage of his convictions, and his sincerity and candour merit our appreciation.

T. E. THORPE.

HANDBOOK OF PATENT LAW OF ALL COUNTRIES. *By* W. A. THOMPSON. *Eighteenth edition. Pp. vi.+157. (London: Stevens and Sons, Ltd. 1920.) Price 6s. net.*

This is a new edition, considerably revised in view of the extensive modifications which the patent law of the world has undergone during the years of war, of a well-known book. It is intended for the assistance of the public, and of inventors in particular, and is compiled from that point of view. The summary given of patent law is terse and popular in form. In substance it covers the points most likely to present themselves to an intending patentee. It is written in a breezy and readable style. Although the title refers only to patent law, the subject matter combines the cognate subjects of Trade Marks, Designs and Copyright registration, these subordinate subjects, however, being dealt with less systematically than the main theme.

In writing on such a subject as English patent law, it is almost impossible to deal satisfactorily with the historical aspects of the subjects, themselves extremely well worth study, in a few words. Thus a sentence such as the following:—"As a rule it is undesirable to make a body corporate one of the applicants, as it is not quite certain whether in such case every member of the said body has not an independent right to use the invention"—is probably misleading. The practice of making limited companies parties to patent applications is a very common one, and the suggestion that every member of such a company has an independent right to use the invention would certainly be received with considerable astonishment by any modern court. There are, no doubt, old dicta, applied primarily to franchises differing in kind from those conferred by a patent grant, which might be quoted in this connexion, but there is no real doubt that they would be promptly swept aside. So again the remark that:—"In old times it was held unconstitutional for the King to grant a monopoly to a foreigner resident abroad"—is a proposition which stands much in need of verification if it is to convey any just impression of the course of development of English law. Here condensation is hardly compatible with the usefully clear statement of the point intended to be made. On the other hand, a very slight amendment would set right the sentence which runs thus:—"The word" (invention) "is derived primarily, as is well known, from the latin *in venire* to come *in*."

These, however, are small matters; they do not affect the value of Mr. Thompson's book, which exhibits in a very compendious form the outlines of patent law in Great Britain, the British colonies and dependencies and all foreign countries that grant patents. Of special interest to its readers will be the accessory information, such as the dates of the various patent laws digested and the populations concerned, which are systematically given. We miss from this what was very useful information in the earlier editions of the book, that is to say, notes of the patent office fees in the various countries.

There is one point of very general interest in respect of which Mr. Thompson has made himself the mouthpiece of a curiously mistaken notion about the British Patent Office. On page 19, speaking of the renewal fees payable under British patents, he says:—"The Board of Trade has power to reduce these taxes, which are much too high and bring large profit to the Treasury." The fact is that the Patent Office, although at present safely paying its way, can hardly be regarded as a revenue producing department at all. The Comptroller General's report for the year 1919 shows a total income from all sources, including profit on the sales of specifications, etc., of £404,474, whilst the expenses of running the establishment were £350,150, showing a profit income of £54,324, which is no more than would be expected to be realised on a commercial venture of corresponding magnitude. No doubt there are risks attending ordinary commercial enterprises from which the business of conducting the Patent Office is free, and the 12 per cent. profit balance may be looked upon as a tax charged upon patentees; but it certainly is a very moderate tax and, having regard to the fact that no patentee pays it unless it is worth his while to do so, the complaint in these days of inevitably high taxation is a little unworthy.

J. W. Gordon.

The Volatile Oils. *By* E. Gildemeister *and* Fr. Hoffmann. *Second Edition by* E. Gildemeister. *Authorised translation by* Edward Kremers. *Second Volume. Pp. xx.*+686. *(London: Longmans, Green and Co.,* 1920.) *Price 32s. net.*

Gildemeister and Hoffmann's work on "Essential Oils" is so well known as to need no recommendation from reviewers. The present volume, however, comes into existence under very unfortunate circumstances. Written mainly in 1912 in German, it was published in Germany in 1913. It appears to have been translated between 1913 and 1916 by Dr. Kremers, printed in 1916, and published in 1920. The translator has allowed himself to translate Dr. Gildemeister's preface, dated "Miltitz, near Leipzig, June, 1913," as "Miltitz, near Leipzig, June, 1916," which we think should not have been done, as no attempt has been made either by author or translator to bring the work beyond the original date of 1913.

The present volume follows the plan of Volume I., the essential oils being enumerated in the order of Engler's "Syllabus der Pflanzen-familien," and the oils dealt with are those up to and including those of the *Zygophyllaceæ* and some of those of the *Rutaceæ*.

If this work were being reviewed in 1913, the reviewer's task would be an easy one, and nothing but praise and commendation could be accorded to it. Unfortunately it is 1920, and the book is so considerably out of date that we think it a pity that it should not have at least been brought up to the latest date possible by the translator. The reason for this serious shortcoming is obvious, but none the less, although every chemist interested in essential oils will welcome the book, the work done between 1913 and 1920 in this field is so great that the book loses very much of its utility.

To illustrate this, attention may be called to a few only of the more important omissions as types of those occurring throughout the volume.

Under the various cedar-wood oils no account is to be found of the work of Roberts on the oil of *Cedrus deodara* (1916), and the interesting researches of Schimmel and Co. on the ketone contained therein (1917). The latest work on cryptomeria oil dealt with is that of Kimura (*cf.* Berichte, 1909, p. 372); but in 1916 So Uchida discovered a crystalline diterpene in the oil, and published interesting details of the odorous alcohol present in the oil. The latest work on the chamæcyparis oils is dated 1910, so that Schorger's work (1914) and Uchida's (1916) are not mentioned. Still, keeping to the *Pinaceæ*, we find no references to Parry's work on "Russian Oil of Turpentine," which was published in 1912, nor, of course, to the exhaustive reports on the various turpentine and wood-turpentine oils of the different pines in the United States made by Schorger and Adams in 1915.

Turning to the oils of the *Gramineæ*, we are pleased to notice that at last we have a definite agreement that "the quality of citronella oil is best ascertained by the quantitative determination of the acetylisable constituents." Those who have perused Messrs. Schimmel's reports for the past ten years will remember how strenuously certain British analysts insisted upon this for years, and how vigorously Messrs. Schimmel and Co. opposed it. It is, however, regrettable that the acetylation is directed to be carried out with equal volumes of the oil and acetic anhydride. This will always give too low results, especially with oils of the Java type, and 10 c.c. of the oil should be treated with 15 c.c. of acetic anhydride. The data concerning ginger oil are, from the cause indicated above, quite out of date, as Brooks in 1916 identified in it the following substances:—methylheptenone, nonyl, aldehyde, linalol, and zingiberol.

A few words only are devoted to the important oils of False Cubebs. This subject was exhaustively dealt with by Oranje in 1914, and any account must necessarily be quite incomplete without reference to this work. Equally true is it that Rabak's interesting work on "Oil of Hops" (1914) is unnoticed; the oil of *Cinnamomum Oliveri* is dealt with on the basis of Baker's work of 1897, which has been superseded and partially contradicted by that of Hargreaves in 1916; oil of massoy bark is stated to contain safrol, Messrs. Schimmel and Co. being the authority; whereas in 1917 the same authority stated that safrol could not be detected. The above are merely a few examples of the inevitable result of publishing in 1920 a work written in 1913 on a rapidly moving branch of chemistry. Due allowance having been made for this circumstance, and judging the book as in 1913, one may accurately describe it as being particularly free from errors of any kind.

E. J. Parry.

PUBLICATIONS RECEIVED.

Organic Medicinal Chemicals. *By* M. Barrowcliff *and* F. H. Carr. *Industrial Chemistry Series, edited by* S. Rideal. *Pp.* 331. *(London: Ballière, Tindall and Cox.* 1920.) *Price* 15s.

India-Rubber Goods Manufacture. *By* "Factory Manager." *Pp.* 496. *(London: Maclaren and Sons, Ltd.* 1920.) *Price 32s. 6d.*

A Text Book of Chemical Engineering. *By* E. Hart. *Pp.* 211. *(Easton, Pa.: The Chemical Publishing Co.; London: Williams and Norgate.* 1920.) *Price $4.*

The Analyst's Laboratory Companion. *By* A. E. Johnson. *Fifth edition. Pp.* 176. *(London: J. and A. Churchill.* 1920.) *Price* 10s. 6d.

THE CONDITION AND PROSPECTS OF THE BRITISH CERAMIC INDUSTRY.

J. A. AUDLEY.

Less than a year ago an Australian buyer entered the office of a well-known North Staffordshire earthenware manufactory, laid down a cheque for £10,000, and said in effect, "There you are! What can you do for us?" It can readily be understood that the manufacturers' representative keenly regretted the necessity of having to explain that it was impossible to do anything at all for at least twelve months. Within the last two or three years incidents of the same kind, though varying as regards the money value concerned, have been by no means infrequent in the ceramic industry. This state of affairs could not, in the nature of things, last indefinitely, and as regards some classes of ceramic products new conditions have already arisen.

It will be remembered that one outstanding consequence of the great war was an enormous dislocation of international trade and commerce. Many things formerly obtained mostly from abroad, and which were included in the category of necessaries, had to be provided somehow in our own country. The manufacture of articles by people with limited experience—workers and supervisors alike—and often under conditions of urgency requiring the promptest possible delivery of the goods, did not tend to the production of the highest quality. The same was largely true also of ordinary commodities, because the ready sale at remunerative prices for home consumption of practically all classes of goods left no incentive to the manufacturers to seek improvements in design, shape, decoration, or general quality, unless such happened to be intimately associated with increased output. Ceramic products were no exception to the general rule, and buyers have been in an unusual degree at the mercy of the manufacturers. The long period of delay in effecting a world settlement has greatly helped to prevent trade from resuming or even approaching its normal course, and the well-meant attempts to establish in this country a state of preparedness for possible future wars—having regard to all the existing circumstances it might not inaptly be expressed as for probable future wars—has militated against any substantial reduction in prices. These considerations, though general in their application, carry greater force in some directions than in others.

The china doll trade affords an instructive example. When few or no dolls were obtainable from abroad, home products supplied the market, but it is well understood that, with rare exceptions, they were decidedly inferior to similar articles formerly imported, besides being more expensive. Instead of seizing the opportunity to establish good models and to produce superior ware from them, the manufacturers were content to pile up profits on easily-made but inartistic goods. The inevitable result is that when dolls from abroad are available, they are found to be not only cheaper, but also much better than those made in this country. So too with fancy ware, which sold well while there were no competitors and money was fairly plentiful, but failed lamentably when faced with serious competition. This likewise was due to the fact that no effort was made to adapt the ware to modern requirements as regards artistic and other qualities, and the sale accordingly fell away. There is still a demand for fancy goods, but not for inferior yet expensive ware which may be ranged in that class. As the world shortage of supplies gradually becomes satisfied, and as international trade relations with Russia, Germany, and other countries get restored, the vegetable and mineral exports from these places will have a powerful effect on the prices of similar commodities in America, and this in turn will affect the prices of pottery, etc., purchased in America from this country and elsewhere. It would therefore be wise for manufacturers to look forward and prepare for the coming fall in prices, to concentrate their efforts on lines that are likely to be in continued demand, avoiding particularly articles which will not be able to compete successfully with cheaper similar goods from other countries. This is not an absolute necessity in the economic situation at the moment, but the rapid changes and tendencies of that situation should be carefully studied, and suitable action taken from time to time in order to be prepared for developments. In this way the probable ill effects of the threatened fall in prices—or, at any rate, the worst of them—would be averted.

The supply of fuel has under present conditions been very far from satisfactory, especially as regards quality, and the restlessness among the coal miners has introduced an additional adverse factor, but the latter difficulty is now causing less anxiety, and improvements in other directions are also hoped for shortly.

The modern tendency to co-operation, which has already proved beneficial to the manufacturers in many industries, has within the last two or three years made such progress among pottery manufacturers that a British Pottery Manufacturers' Federation has been formed, and has already amply justified its existence, though serious difficulties still lie ahead. It includes most of the manufacturing firms, but not all. Before the war, wages in the pottery industry were notoriously low. The very abnormal conditions which resulted during and after the war provided a good opportunity for a great improvement to be made in this respect without causing any serious inconvenience. The poor pre-war wages scale was by some attributed to foreign competition, more especially on the part of Germany and Austria. This view was apparently negatived by the fact that by means of mass production of a few specialities, using modern appliances and methods, several British firms had actually competed successfully against German firms in Germany itself, in spite of tariffs and other obstacles. A much more probable explanation is that given by the representative of a prominent manufacturing firm, who candidly expressed his belief that it resulted from bad organisation.

There is less difficulty about a general rise in prices than in a fall. The inevitable fall in prices which will sooner or later follow a continuous decline in trade—the invariable sequence after the rise in prices which accompanies great wars, as far back as the wars of Napoleon at least, though the prices have never gone down to the pre-war level—will provide a troublesome problem for the industry, because the smaller manufacturers are much weaker economically than the larger firms, and any weakening on the part of the smaller firms will to some extent weaken the stronger position of the larger manufacturers. This difficulty might be met by the adoption on the part of the Manufacturers' Federation of appropriate schemes of selling; co-operative selling would be advantageous, especially for the smaller firms. This, however, can hardly be accomplished effectually unless standardised goods are produced under a system of scientific costing. Present prices were arrived at by merely adding percentages to pre-war prices, but the latter differed from factory to factory according to the more or less economical production of the several articles, or to the varying amounts of the profits reserved by the different manufacturers.

British ceramic products, so far at least as the better class articles are concerned, are distinguished by the good potting of the body composition, and by the excellence of the glaze and colouring. So long as these features are maintained, the ware will always be in demand abroad, but the extent of that demand will depend largely on other considerations, notably on the selling price.

Chemical porcelain was entirely imported into Great Britain before the war; it was one of the few ceramic lines not produced in this country. When the supplies were no longer available, it became necessary to provide a substitute. A number of firms carried out experimental work, and most of them obtained encouraging results; of these firms the Royal Worcester Porcelain Co., Ltd., and Messrs. Doulton and Co., Ltd., persevered so far as to supply in quantity various articles for laboratory use, and continue to do so. Some of these British products were favourably reported on by the National Physical Laboratory. With reasonable care they may be used for most of the purposes of laboratory porcelain ware, but they can scarcely be regarded as more than serviceable substitutes, and it would not be correct to state that they are equal to the Berlin porcelain, for example, which stands very severe heating tests. The British ware has not the same composition, nor are the firing conditions the same as for the continental hard porcelain, and the continuance of a demand for it must presumably depend on the maintenance of a high quality, coupled with the ability to compete successfully as regards price with the foreign hard porcelain.

At the research establishment connected with the Stoke-on-Trent Pottery School, investigations have been carried on for about three years under the direction of Dr. J. W. Mellor and Mr. Bernard Moore, with a view to the production of hard porcelain. A type of hard porcelain suitable for domestic ware, and made from British materials by essentially British methods, constitutes one gratifying result of this work. Pieces have been produced exhibiting a wide range of colour decoration, and some manufacturers have undertaken to produce this ware on a commercial scale, but the prevalent abnormal trade conditions have for the time being hindered developments. True hard porcelain has also been made on a small scale at the same institution, but in this direction also no further development has yet taken place.

Brief mention may here be made of the "Vitreon" ware placed on the market by Messrs. Shanks and Co., Ltd. This is a fine white stoneware of great strength and impermeability, which is largely used for various articles needed in chemical manufacturing processes, and seems likely to compete successfully with the best German stoneware.

Royal Sanitary Institute.—The Henry Saxton Snell Prize of fifty guineas and the medal of the Institute are offered for an essay on "Suggestions for a System of Central Hot-Water Supply and Heating, adapted to Modern Housing Schemes, and to existing Groups of Houses." The essays, which should deal with the central installation, the distribution and conservation of the heat, the provision of continued supply during repair, the cost and combination with other services, must be sent before August 31, 1921, to the Secretary of the Institute, 90, Buckingham Palace Road, London, S.W., from whom all particulars can be obtained.

CHEMISTRY OF CLARIFICATION IN PLANTATION WHITE SUGAR MANUFACTURE.

J. P. OGILVIE.

In the Board of Trade returns relating to the importation of goods into the United Kingdom, all white sugars are collected for the sake of convenience under the heading of "refined." It is to be noted, however, that a good proportion of the white sugars bought by us since 1914 has been of the grade known as "plantation white," that is, a product made in the factory directly from the cane juice without being submitted to the refining process (which comprises re-solution, decolorising by passing through animal charcoal, and recrystallising). Such a tropical white sugar, though generally lacking the beautiful appearance of the best refined, has a ready sale, not only for use in the home, but largely in the confectionery, jam, biscuit, and condensed milk industries.

Undoubtedly, the clarification of the juice is the most important operation in making plantation white sugar. It is, therefore, of interest to notice briefly the essential differences between the procedure followed and that used in manufacturing the lower grade product requiring to be refined before it can be consumed.[1]

Cane juice as it comes from the mills is a light-grey to dark-green turbid and frothy fluid, which, in addition to sucrose and reducing sugars, contains in solution free organic acids (as aconitic, glycollic, oxalic, malic, etc.), organic and inorganic salts, gums and pectins, proteins, such colouring matters as anthocyanin, saccharetin, and the ferric-polyphenol compounds recently investigated by Zerban.[2] It also holds in suspension very fine particles of the crushed cane (so-called "cush-cush," or *bagacillo*), chlorophyll, wax, and lastly a little sand and clay, all of which solid impurities have escaped retention by the strainers of very fine mesh through which the liquid coming from the mills is preliminarily passed. Owing to its content in gums and pectins, it is unfortunately impracticable to filter the raw juice, either through cloth, sand, bagasse, or other medium.

In making ordinary raw sugar, the process of clarification adopted consists briefly in adding milk of lime to slight alkalinity or to neutrality (to litmus), heating to about 90° C., and allowing to subside in suitable settling tanks, the juice decanted from the scums and "mud" being sent to the multiple-effect evaporators for concentration to a syrup, from which the sugar is subsequently crystallised in the vacuum pan. This treatment is far from efficient in eliminating the soluble and insoluble impurities. It results in the free acids being neutralised, the proteins and nucleins being coagulated, and most of the floating "cush-cush," wax and clay being enveloped in the precipitate. Pectins and gums, it should be noted, are only partly eliminated by the small quantity of lime used. Regarding the colouring matters, the chlorophyll present in suspension is removed with the other floating substances, but the anthocyanin pigments coming from the bark of the cane remain to a large extent in the juice, adding very materially to its colour, especially if the variety of the cane being crushed is a very dark one. Saccharetin, which is a soluble pigment, and possesses the character of an indicator, being intensely yellow in alkaline solution, and colourless in an acid medium, likewise remains, as do also the ferric-polyphenol compounds, which similarly contribute largely to the colour of the juice.

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[1] A very good account of tropical white sugar manufacture is given by Harloff and Schmidt in their "Handleiding voor Tropische Witsuikerfabricatie," which has just reached its 4th edition. An English translation of this work (from the 2nd edition) appeared in 1913.

[2] This J., 1918, 778A; 1919, 192A.

This method of treating with a small amount of lime, generally known as the "defecation process," by no means exerts the maximum clarifying effect. It gives a juice containing a certain amount of solid impurities in suspension, which accumulate in a rather dark syrup, and later during graining in the vacuum pan become incorporated between the *lamellæ* of the crystals, imparting to them a dirty colour incapable of removal by washing in the centrifugal machines with syrup, water, or steam. Not the least of the several defects of the defecation process, however, is that it may actually permit the formation of colouring matter. This is largely due (though apparently not entirely)[3] to the rather ready decomposition of dextrose and lævulose (comprising the so-called "glucose") at temperatures above 55° C., especially in an alkaline medium, viscous, dark-brown calcium salts of glucinic and saccharinic acids being produced. These decomposition products of "glucose" are probably the most inimical substances with which one has to deal in white sugar manufacture. They are only partly and temporarily bleached by sulphur dioxide, or by sodium hydrosulphite, and being very soluble persist through the several stages of manufacture, finally imparting a faint tinge of colour to the finished white sugar. Their formation must consequently be avoided as far as possible.

In white sugar manufacture, on the other hand, the method of clarification chosen is much more thorough, especially in regard to the elimination of the pectins and gums. Processes have been adopted which produce such a clarifying effect that these troublesome constituents are eliminated to a sufficient extent to enable the juice to be passed through cloth; which avoid largely the formation of decomposition products of "glucose" during evaporation; which permit crystallisation to take place in a syrup light in colour and free (or almost so) from insoluble matter; and lastly, which enable the molasses or mother-liquor adhering to the mass of crystals (the *massecuite*) dropped from the vacuum pan to be cleanly and easily removed by washing in the centrifugals. When these conditions are fulfilled, a sugar may be obtained of excellent colour, although as a rule one must admit that it is never so faultlessly white as the best crystals refined by the use of animal charcoal.

This improved clarifying effect is produced by the addition of an excess of lime, which is afterwards removed by means either of carbon dioxide (carbonatation), or of sulphur dioxide (sulphitation), a large amount of finely divided precipitate being thus formed in the juice. In this short note, it is impossible to present details of these processes and their several modifications, and space can only be found to describe the chemical effects resulting, so far as these are known.

In regard to the action of carbonatation and sulphitation on the constituents of the juice, it may be pointed out that proteins, nucleins, gums and pectins are partly removed from solution on the addition of the lime, and provided that sufficient of this reagent has been used all the anthocyanin is eliminated also. Altogether a considerably greater precipitation of impurities occurs than that resulting from the small amount of lime used in the defecation process. It is, however, the subsequent formation of the voluminous precipitate of calcium carbonate or calcium sulphite that completes the maximum clarifying effect obtainable; and there seems little doubt that adsorption of the colloidal impurities then occurs. That this is so appears to be supported by the fact that the order of addition of the alkali and acid may be reversed with no apparent difference in the result; as, for example, when the juice is first sulphited and afterwards limed (which, as a matter of fact, is the usual procedure in some countries).

In a certain important modification of the carbonatation process that is now being used in factories in Java, instead of adding all the lime at once, liming and gassing are carried on almost simultaneously, conditions being so adjusted that only a slightly alkaline reaction is maintained throughout. This variation of de Haan[4] has proved very advantageous in practice for the reasons that the danger of colour formation by the action of an excess of lime on the "glucose" is avoided; that the utilisation of the gas is improved; that the operation is more rapid; that frothing (one of the inconveniences of ordinary carbonatation) does not occur; and, lastly, that less lime is required. But what is of interest to note is that it has been proved that this modification gives the same result in regard to the elimination of impurities as does ordinary carbonatation, in which a large excess of lime is allowed preliminarily to act upon the juice. Since during the de Haan treatment the amount of lime acting upon the impurities is probably little in excess of that used in the defecation process, it is difficult to believe that the elimination of the impurities effected is mainly due to its action. It seems much more reasonable to regard these observations as further evidence that the clarification of cane juice by such processes is largely an adsorption phenomenon rather than a purely chemical process.

In fact several workers, as Deerr, Norris, and Peck[5] have recently emphasised the importance of regarding clarification from the standpoint of colloid chemistry; whilst Geerligs in one of his latest works[6] points out that "the clarification of cane juice by chemicals does not eliminate from the juice any great amount of impurities but it is more the improvement of the physical properties which is effected, as, for example, the removal of the small amount of colloidal matter which hinders the juice from being filtered and keeps afloat the suspended ingredients. . . ."

Furthermore, Zerban,[7] in a publication which has just come to hand, shows by both laboratory and factory experiments that an efficient clarification can be brought about without the use of any chemicals at all; but simply by the use of efficient adsorbents. Kieselguhr and decolorising carbon were the materials used,[8] the procedure being to boil the juice coming from the mills with 0·5 per cent. of the infusorial earth, pass through cloth, heat with about 1 per cent. of high-power decolorising carbon, and again filter. Juice that was brilliant and almost colourless, and that gave an excellent quality and high yield of white sugar, was thus obtained.

This is certainly a result of much importance, which, it may be added, has been confirmed by tests carried out independently in certain factories in Louisiana. Its adoption in practice would depend mainly upon the availability of cheap and efficient adsorbents. There are on the market at the present time several decolorising carbons that are very satisfactory from the point of view of high adsorbing power; but the general opinion of sugar manufacturers and refiners appears to be that these are too costly for extended application. It would certainly be a matter of great interest to discover a means of producing at a low figure a carbon having a high power of adsorption towards the colloidal impurities, *e.g.*, the gums and pectins and colouring matters, present in sugar juices and syrups whether this were obtained directly by a simple process of manufacture, or indirectly as a by-product. Such a carbon, as these experiments of Zerban indicate, or some other cheap adsorbent, would doubtless find a wide application in the sugar industry. It would probably enable most tropical factories now turning out low-grade "raws" to produce white sugar which would surpass in quality that now obtainable by the carbonatation and sulphitation processes. It might ultimately be the means of realising the possibility, which some conceive, of producing directly from cane juice on the plantation a grade of sugar rivalling that now made only in the refinery.

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[3] This J., 1920, 667A.

[4] U.S. Patent, 1,101,071; this J., 1914, 801.

[5] This J., 1919, 192A.

[6] "Practical White Sugar Manufacture," pp. 62-63.

[7] *Louisiana Bulletin*, No. 173.

[8] *Cf.* also German Patent, 332,135; this J., 1920, 668A.

THE ELECTRIC FURNACE IN THE AMERICAN METAL INDUSTRIES.

In the issue of *Chemical and Metallurgical Engineering* for November 17, 1920, appeared an article by R. M. Keeney on the technology and future possibilities of the electric furnace as applied to the manufacture of iron and steel, ferro-alloys, heat treatment, brass melting, and the smelting of non-ferrous ores. This paper, of which a short abstract is given below, forms a useful complement to the paper on recent developments of the electric furnace in Great Britain, which was read by D. F. Campbell at the annual meeting of this Society in July last (*cf.* J., 1920, 224 T).

During the last decade great progress has been made both in America and Canada in the application of electric furnaces to the iron and steel industries. Although this expansion was chiefly due to the exigencies of war, it is probable that the electric process will definitely supersede other processes for the production of steel castings and be widely used for the treatment of molten Bessemer and open-hearth steel.

Pig Iron.—The production of pig iron from electric smelting furnaces was for the first time proved a commercial proposition by D. A. Lyon at Heroult, California, in 1908. This process has been abandoned, and pig iron is now produced by electric melting of scrap. In Sweden and other countries, however, the development of the ore-smelting process has been steady, and both shaft and open-pit type furnaces have been used. The former resembles Lyon's shaft furnace, which was especially adapted for the production of low carbon and low-silicon iron, whereas with the latter, foundry iron can be produced and coke can be largely substituted for charcoal as a reducing agent. The future development of ore smelting in the United States is doubtful, but there is a possible future for the direct conversion of scrap iron and steel into pig-iron or castings. This synthetic process was largely developed in France, where 220,000 tons of iron was produced during 1916, 1917, and 1918. The electric furnace has also been used for desulphurising cupola metal and for the production of malleable castings.

Steel.—The number of furnaces in the United States and Canada has increased since 1907 from 7 to 363, whilst the output of electric steel in the United States for 1918 amounted to 511,364 gross tons. The electric process has found successful application in the manufacture of various alloy and high-speed steels, but when making carbon steel approaching best crucible quality only the purest raw material must be used.

Considerable development in the direction of refining molten metal may be looked for in the future, and already the Illinois Steel Co. has installed ten 30-ton furnaces for a triplex Bessemer open-hearth electric process.

Electric-steel Castings.—Electric-steel castings can now be made more cheaply than converter and open-hearth castings, even by firms purchasing their power from outside sources. The rapidity of melting ensures small but frequent supplies of liquid steel, which is very advantageous in foundries. As most foundries operate on a 10-hour day, a load factor of 18 to 30 per cent. only is possible, but where continuous operation is practised the load factor can be raised from 40 to 55 per cent.

Recent Modifications of Furnace Designs.—The design of recent types has generally followed the principle of the three-phase Heroult furnace. At the same time there has been a growing tendency towards the use of three-phase current and automatic control, the reduction of the reactance in primary circuits and the elimination of hearth conductors carrying all the current load. The best central station load is obtainable with furnaces operating at a power factor of 0·80 to 0·85.

Electrical Heat-treatment.—Considerable progress has been made with electric furnaces for the heat treatment of steel. The heating element consists of granular carbon confined in carborundum fire-sand troughs. The load is easily controlled by using a multi-tap furnace transformer. Single-phase furnaces of 900 k.w. capacity have already been installed, and this system of heating is certain to be greatly developed in spite of its higher cost. In another type of resistance furnace the heating element consists of a nickel-chromium alloy ribbon wound on a suitable framework; such furnaces have been built of 400 k.w. capacity.

Ferro-alloys.—In the last ten years the power capacity of ferro-alloy plants in the United States has increased from 20,000 to 200,000 k.v.a., but at the present time probably 75 per cent. of these plants is not operating. Further knowledge of the value of molybdenum as an addition to binary and ternary alloy steels has resulted in very marked increase in production of the ferro-alloy, whereas market conditions during the war were alone responsible for the increased output of ferro-manganese and ferro-chrome. These alloys are best made in three-phase furnaces, whilst the small single-phase furnace of Siemens type is preferred for smelting tungsten, molybdenum, uranium, and vanadium ores.

Brass.—The use of electric furnaces for melting non-ferrous metal and alloys has grown remarkably during the past five years. In March, 1920, there were 261 units installed with an estimated total load capacity of 23,000 k.v.a. One-third of this load is taken by resister furnaces, one half by arc furnaces, and the remainder by induction furnaces of small capacity. For brass-melting the power consumption varies from 250 to 400 k.w.-hrs. per ton. Single-phase furnaces are almost exclusively used.

Zinc.—Zinc is not being smelted commercially in the United States, although considerable experimental work has been done and the condenser problem apparently solved. In Sweden 15,000 k.v.a. is being utilised at two plants for ore and dross smelting.

Future Development.—The limitation of the electric furnace is primarily defined by the cost of power. For melting steel and non-ferrous metals a price of 1 cwt. per k.w. hour is reasonable, but this would prove altogether prohibitive for the production of ferro-alloys.

Future progress may be expected in the following processes:—(1) Iron castings from scrap or a duplex process of cupola melting with electric furnace refining; (2) steel castings and alloy steels; (3) ferro-alloys; (4) aluminium; (5) brass melting; and (6) electric smelting of non-ferrous ores.

OCIETY OF CHEMICAL INDUSTRY.

OINT MEETING OF THE SOCIETY WITH THE INSTITUTION OF MECHANICAL ENGINEERS.

A joint meeting of this Society and the Institution of Mechanical Engineers has been arranged, at which Monsieur Paul Kestner, President of the Société de Chimie Industrielle, will read a paper on "The De-gassing and Purification of Boiler Feed Water." All members of the Society will be cordially welcome to the meeting, which will be held at the Institution of Mechanical Engineers, Storey's Gate, Westminster, S.W. 1, on Friday, March 4, at 6 p.m.

JANUARY MEETING OF COUNCIL.

The monthly meeting of the Council was held on January 14, Sir William J. Pope presiding. Among other matters dealt with the following may be mentioned:—

Arrangements were agreed upon for taking over the Society's share of the estate of the late Dr. Rudolph Messel, and it was resolved to comply with the testator's wish that the fund should be kept separate from the other funds of the Society. As, under the Society's by-laws, the trustees of the fund must not be members of Council, it was agreed to ask Dr. C. C. Carpenter, Mr. E. Grant Hooper, and Prof. G. G. Henderson to act in this capacity.

It was decided to proceed with the printing and publication of the fifth volume of the Society's Annual Reports of the Progress of Applied Chemistry, and that it should be sold to members at the price of 7s. 6d., and to non-members at 15s., plus 9d. postage, in each case. It was further resolved to offer to purchasers of Volume V. a set of the remaining copies of Volumes II., III., and IV. (Volume I. being out of print) at a reduction of 25 per cent. of the total price.

Seventy-nine new members were elected (as compared with 72 in January, 1920), of whom 64 are home members, 8 colonial, and 7 foreign.

The representatives appointed at the request of the National Physical Laboratory to consider its note on "Tests of Graduated Glassware" submitted a report on the subject, which was adopted by the Council, and ordered to be sent to the Director of the Laboratory.

On the nomination of the Committee of the Chemical Engineering Group, Messrs. C. S. Garland, C. L. Goodwin, J. W. Hinchley, W. R. Ormandy, and J. A. Reavell were elected the Society's representatives on the Chemical Engineering Committee of the British Engineering Standards Association.

The Council had before it a report received from the committee of the Nottingham Section on the subject of "The Recent Policy of the Publications Committee." The chairman and hon. secretary of the Section were present and amplified the views set forth in the report. A discussion followed, and the thanks of the meeting were given to the committee and its representatives for having brought forward the matter.

It was resolved that the Society as a whole should participate in the joint meeting to be held with the Institution of Mechanical Engineers on March 4 (*cf. s.*).

NEWS FROM THE SECTIONS.

MANCHESTER.

The fourth meeting of the session was held on January 7 at the Textile Institute, Mr. J. Allan presiding over an attendance of about eighty.

Dr. A. W. Crossley read a paper on "An Industrial Research Association," in which he discussed its objects, its relation to other research institutions, especially universities, and co-operative laboratories. Dr. Crossley contended that underlying theory was the fundamental object of research work and, applying this contention to the research laboratory established at Didsbury by the Cotton Research Association, said that it had been decided that the work there should not be based on previous industrial experience, but that investigation of the single fibre should be the fundamental object. Dr. Crossley also urged that the publication of all results is of the utmost importance. Among the points brought out in the discussion were the undesirability of reserving accommodation for research at universities to particular firms; that "investigation" was not necessarily "research"; and that much so-called rule-of-thumb work was essentially of a research character.

BRISTOL AND SOUTH WALES.

At the meeting held in Bristol on January 6, Mr. E. Walls presiding, Mr. C. E. Boucher read a paper on "Some Aspects of Chemical Work in Pharmacy."

Following a historical introduction, the lecturer discussed the difficulties connected with preparation, standardisation, and preservation, selecting opium as an example. He then outlined the trend of modern pharmacy, and laid particular stress upon the need for duty-free alcohol. The chairman also pressed the latter point, and spoke of the debt that the chemist owes to the pharmacist.

The first meeting of the Section in Swansea was held at the Royal Institution on January 7. Prof. C. M. Thompson, of Cardiff, presided, and members of the South Wales Section of the Institute of Chemistry were present by invitation.

In a paper on "Coal," Mr. C. A. Seyler outlined the development of its classification from the earlier attempts of Regnault, in 1837, to the more scientific methods now adopted, which are based on the relative amounts of carbon and hydrogen in the pure coal substance, and showed how well the results of these agreed with the data derived from the study of the geological and geographical distribution of the South Wales coalfield. He traced by means of charts and maps the gradual changes from the centres of anthracitisation outwards, showing how the physical, chemical, and palæobotanical characters change concurrently with the changes in carbon and hydrogen contents. The speaker showed slides of present and fossil forms of Lycopods and Sigillarias, compared these with a number of photomicrographs in natural colours, and pointed out the fossil structures therein.

The chairman announced that it was proposed to hold two meetings in Swansea next session, provided papers could be obtained from local members.

YORKSHIRE.

The second meeting of the session was held in Leeds on January 17, with Dr. L. L. Lloyd in the chair.

Mr. H. J. Hodsman described and exhibited a new form of apparatus for sodium peroxide fusions, which consists of an elongated steel crucible about 4 in. long by 1 in. in diameter and closed by a well-fitting lid. The crucible is encased in an outer steel tube the cover of which slips on with a bayonet joint. In this apparatus the fusion of organic substances, especially fuels, can be carried out safely and conveniently by simply heating the outer tube in a bunsen flame.

A short paper by Messrs. B. A. Burrell and G. W. Douglas, entitled "The Presence of Nitrates in the Leaves of Trees Growing near a Picric Acid Works," was read by the latter. Damaged and undamaged leaves were examined by extracting with cold water and estimating the nitrate content of the extract by the colorimetric method, using brucine and oxalic acid. The damaged leaves all showed the presence of nitrate, the amount of which varied from 0·05 to 0·38 per cent. (expressed as nitric acid), whilst the undamaged leaves from the vicinity of the works and also from other districts of Yorkshire showed no trace. It was observed that beech trees were most susceptible to the fumes.

At the conclusion of the meeting a burette-holder, designed by Mr. F. Firth, was exhibited. The burette is held in a clip attached to a jointed arm similar to an ordinary gas bracket, so that it can be pulled forward when required and pushed back against the wall to leave the bench clear when not in use.

LIVERPOOL.

On December 17, Mr. P. G. Jackson read a paper on "Boiler Feed Water—from the chemist's point of view," in which he discussed the formation of scale in boilers, corrosion of the iron or steel of which they are constructed, of the brass or gun-metal fittings, overheating, and priming or foaming of the water. The various theories of corrosion, the author believes, are almost all correct, but the electrolytic theory is the only one which, in many cases, can explain why corrosion occurs at a particular point. Oxygen is difficult to remove, and usually must be allowed to remain, although in some cases a small quantity of tannic extract may be added; but as tannic acid is itself corrosive, it should be neutralised with soda, and then used only in small amount as the salt is readily dissociated. Undue aeration of a feed water should be carefully avoided. Corrosion due to oxygen and carbon dioxide may usually be recognised by the presence of gas bubbles on rough surfaces lying more or less horizontally, and where the water circulation is defective; in the latter case the pittings are nearly circular in shape, sharply-defined, and isolated. Much experience is necessary to infer from an analysis whether the magnesium salts present in a water are likely to cause corrosion. Magnesium chloride and nitrate, if present in more than very small quantities, are almost certain to cause it, unless sufficient calcium carbonate is present to neutralise their action. Nitrates, when in concentrated solution, cause trouble in boilers working at, say, 150 lb. per sq. in. pressure; the maximum permissible concentration should not exceed 100 grns. per gall. Iron and ammonium salts are especially deleterious, but, in the author's opinion, sodium carbonate is not corrosive.

After discussing the control of feed-water supplies with and without softening plant, Mr. Jackson described boiler troubles due to "priming," which he classified into "foaming" and "bumping." Foaming occurs readily when either soapy matter or certain colloidal organic substances are present in the water, and is probably due to the presence of large numbers of minute suspended particles acting as nuclei for the formation of steam bubbles and causing too rapid ebullition. Bumping may be prevented or minimised by providing ample steam space, excluding soapy water or saponifiable oils, avoiding excessive concentration of saline constituents, and by excluding finely-divided organic or mineral matter, and oil or other substances which may form a scum on the surface of the water. Overheating of certain parts of the boiler frequently occurs when the metal has become distorted or bulged, and is nearly always due to the presence of oil in the scale; and it is therefore very important to exclude grease from the boilers. Oil should be eliminated by chemical means; ordinary softening treatment will remove it from a hard water (with the precipitate), but for a soft water alumino-ferric should be used.

MEETINGS OF OTHER SOCIETIES.

THE CHEMICAL SOCIETY.

In a lecture delivered to the Chemical Society in December last, Sir Robert Robertson, Director of Explosives Research, Research Department, Woolwich, described some recent work carried out there on the "Properties of Explosives."

The lecture embodied an attempt to correlate the explosive properties of simple explosives with their chemical composition and constitution. It was shown that the percentage of oxygen which was required to oxidise the combustible elements in the explosive was intimately related to its properties, and also that constitutional changes, such as the arrangement of nitro-groups in isomeric compounds, were responsible for differences in the effects produced. The properties considered were heat of formation, heat of explosion and gases evolved, chemical stability, sensitiveness to shock, rate of detonation and pressure developed; and in each case the description was prefaced by an account of the most recent methods employed by the Research Department, Woolwich, for determining the values. In many cases quantitative results were obtained which make it possible to measure the properties of explosives in terms of definite physical units, instead of by personal estimates of effect, as hitherto.

The influence of the heat of formation as well as of the completeness of the oxygen balance was illustrated by a comparison of the thermal data given by nitroglycerin, trinitrotoluene and trinitrophenol, reference being made to a new set of values for heat of formation of the most important nitro-derivatives of benzene, toluene, phenol, and methylaniline. Values for the heat of explosion, obtained under conditions of standard density of loading of the explosive in its containing envelope, were quoted, and the similarity of trinitrotoluene and trinitrophenol in this respect was traced to the higher heat of formation caused by hydroxylation, as compared with methylation, of benzene.

The factors influencing rate of decomposition were discussed, and examples given of temperature coefficients. Variations in chemical stability were illustrated by a table in which the rate of gas-evolution from a number of explosives was compared at a common temperature, and the influence traced of such factors as the introduction of nitro-groups, of methyl groups, and of the hydroxyl group into the ring, the arrangement of the nitro-groups in the compound, and the physical condition of the explosive undergoing decomposition. The resistance to decomposition by heat was in many cases shown to run parallel with the ease with which the explosive compounds can be hydrolysed. Values for insensitiveness to shock were quoted for a number of explosives, and some effects noted of constitutional arrangements, such as want of symmetry in the disposition of nitro-groups, conducing to greater sensitiveness. The rates of detonation under conditions of high density of loading were given for a few explosives.

The important principle, enunciated by the late Prof. B. Hopkinson, concerning the measurement of the pressure of a blow was illustrated by a description of the work done on this quantitative method as applied to explosives. It consists essentially in the separation of the momentum of the blow into pressure and time, of which the latter is known. Attention was called to the necessity for maintaining constant the density of loading of the explosive and the thickness of its containing envelope. Values illustrating these points, as well as the effect of certain constitutional arrangements on the violence of the detonation were given, as were also indications of the applicability of the method to many problems in explosive research in which the violence of the blow delivered has to be investigated.

In the second part of the lecture the explosive properties of the Amatols (mixtures of ammonium nitrate and trinitrotoluene) were described. These mixtures were put forward early in 1915 by the Research Department, Woolwich, to meet the shortage of trinitrotoluene, and ultimately were used in enormous quantities for filling shells, bombs, and other warlike appliances.

As Amatol 80:20 has its constituents nearly adjusted for complete combustion, its heat of detonation can be calculated, since the heats of formation of the constituents and final products are known. The values actually obtained for heat of explosion and for gases evolved in the high-explosive calorimetric bomb were shown to be in very fair agreement with the calculated quantities. The chemical stability of these mixtures and the influence on them of certain impurities were discussed, and the values obtained for sensitiveness and rate of detonation were given. The application of the pressure bar to the investigation of these mixtures clearly showed that the ammonium nitrate is not to be looked on as a diluent of the high explosive; it is more than a convenient source of oxygen, being itself an explosive.

The lecture, which contains many numerical values for which the original must be consulted (Chem. Soc. Trans., **119** (1921), p. 1), concluded with a tribute to the enthusiasm of the scientific staff of the Research Department, Woolwich.

At the meeting of the Society held on January 20, Sir J. J. Dobbie announced the deaths of Sir Lazarus Fletcher, head of the mineral department of the British Museum since 1878, of Mr. Charles Simmonds (*cf.* p. 29 R of this issue), and of Mr. S. A. Vasey, who directed the *Lancet* laboratory for twenty-eight years. The vacancies on the Council, to be filled at the annual meeting in March, were also announced.

The list of papers to be communicated contained twenty items, of which the following were read in abstract:—The formation of derivatives of tetrahydronaphthalene from γ-phenyl fatty acids: G. A. R. Kon and A. Stephenson. Quantitative reduction by hydriodic acid of halogenated malonyl derivatives. Pt. I.: The amides of sym. dialkyl and aryl substituted amides of mono- and di-bromomalonic acid: J. V. Backes, R. W. West, and M. A. Whiteley. Dihydroxynaphthaldehydes: G. T. Morgan and D. C. Vining. Researches on residual affinity and co-ordination. Pt. III.: Reactions of selenium and tellurium acetylacetones: G. T. Morgan and H. D. K. Drew. Ortho-chlorodinitrotoluenes. Pt. II.: G. T. Morgan. The constitution of catechin. Pt. III.: Synthesis of *aca*catechin: M. Nierenstein. Chlorine overvoltages: E. Newbery. The influence of mercury, sulphur, arsenic, and zinc on the catalytic activity of platinum: E. B. Maxted. The conditions underlying the formation of unsaturated and of cyclic compounds from halogenated open-chain derivatives. Pt. I.: Products derived from α-halogenated glutaric acids: C. K. Ingold.

There will be an informal meeting of the Society on February 3, following an ordinary scientific meeting.

ROYAL PHOTOGRAPHIC SOCIETY.

At the meeting held on January 11, arranged by the Scientific and Technical Group, the president announced that the Society's progress medal had been awarded to Mr. F. F. Renwick for researches in the chemistry and physics of photography.

Mr. J. Rheinberg, in discussing "Some New Directions for Photographic Research," dealt chiefly with the variation of the physical properties of colloids which can be induced by such factors as change of solvent, light action in presence of certain salts, etc. In his own work the most important property which he had controlled in this way was the permeability of colloidal membranes to certain solvents; for example, films of gum arabic or fish glue, sensitised with a ferric salt, became more permeable, on exposure to light, to slightly acidified alcohol, thus allowing the extraction of dye from an underlying collodion film. This property was utilised in the manufacture of a mosaic colour screen and also in preliminary experiments for the production of graticules, not carried to completion because of the discovery of the "grainless photography" method. He referred also to the advantage of using methyl alcohol as a solvent for pyroxylin, thus avoiding the objection to mixed ether and alcohol which by reason of their very different rates of evaporation lead to irregular films on drying.

In the paper on "White Light Development," Mr. B. V. Storr gave a short account of the work of Lüppo-Cramer on the reduction of light-sensitiveness of photographic emulsions produced by certain substances. The desensitising action possessed by developing solutions was found to vary considerably with different developers and to be greatest with amidol in the absence of sulphite; further experiments showed that the active desensitiser is the oxidation product of the developer, and this led to a search among dyes of similar composition to the oxidation products. The most active dyes discovered are those of the safranin class, a reduction of sensitiveness of as much as 600—700 times being obtained with phenosafranin. This property is the basis of the process of white light development, which was later demonstrated by Mr. Storr and Mr. H. Flower by developing Special Rapid and Panchromatic plates in white light, after a preliminary bathing in a 1/5000 dye solution. The dye used, of which samples were distributed amongst the members of the Society, was not phenosafranin, but a closely allied substance with some advantages in lesser staining and no tendency to produce veil. Messrs. Ilford, Ltd., hope to place this dye on the market very shortly, thus rendering the process available for general use in this country.

INSTITUTION OF PETROLEUM TECHNOLOGISTS.

At the meeting of the above Institution held on January 18, a paper on "The Carbonisation of Lubricating Oils in Internal Combustion Engines," by Mr. F. H. Garner, of the Mellon Institute, Pittsburgh, U.S.A., was read in the author's absence by Dr. W. R. Ormandy.

In this paper the author dealt with the cause of carbonisation of lubricating oils in the cylinders of high-speed internal combustion engines, and showed that the suction stroke of the engine is the most important of the whole cycle from the lubricating standpoint, the leakage of oil from the crank chamber during this stroke being the origin of the carbon deposits formed. The question of tests to determine the tendency of an oil to carbonise under such conditions was fully discussed, and a series of tests was given for carrying out these determinations. The carbonisation is influenced by the amount of asphaltic resins present in the oils. The method of determination of asphaltic resins given by the author was one based on that of Rakusin (J. Rus. Phy. Chim. Soc., 1916, 48, 720) in which the oil is mixed with animal charcoal. The asphaltic resins are adsorbed, and the free or loosely combined oil is then extracted by petroleum spirit, in which the adsorbed resins are insoluble; the latter are then estimated by extraction with chloroform. Experimental work was carried out on a series of lubricating oils from Texas and Pennsylvania crude petroleum, and it was found that:—(*a*) Oils of similar distillation range have similar evaporation losses at the same temperature, irrespective of their origin; (*b*) there is a direct connexion between the evaporation loss and the fire test of an oil; (*c*) carbonisation, that is percentage of asphaltenes formed, increases on heating much more rapidly than the evaporation loss; (*d*) in similar oils the resin content influences the extent of carbonisation at high temperatures and also the coke value as determined by Conradson's method. The author stated that Conradson's method is a better criterion of the behaviour of the oil in the engine, as regards the formation of carbon deposits, than the carbonisation tests.

In the ensuing discussion, Mr. L. Archbutt stated that in carrying out carbonisation tests he used a large quantity of oil, heated it for 48 hrs., and then did comparative tests on viscosity and acidity; there was a direct relationship between the results of these tests and the behaviour of the oil in practice. Mr. E. A. Evans expressed the opinion that the question of carbonisation had hitherto been approached from a wrong standpoint, viz., that carbonisation was due to the decomposition of unsaturated hydrocarbons; this assumption was open to question. He was at present investigating the tendency of pure hydrocarbons to carbonise and was obtaining very interesting results. Mr. H. Barringer suggested that the carbonisation might be due to extraneous hydrocarbons present in the oil as now sold; and Mr. G. Pitt that oils should be sold on their carbonisation values. Dr. R. Lessing drew attention to the similarity of the asphaltic bodies to those present in coal tar. Dr. M. B. Blackler stated that he had had considerable experience during the past few years in the treatment of lubricating oils in order to obtain fully saturated medicinal oils, and suggested that the proportion of unsaturated hydrocarbons to saturated hydrocarbons in the oil played a great part in determining the carbonisation values.

Dr. W. R. Ormandy, in reply, mentioned that the Diesel Engine Users' Association had investigated the carbonisation of fuel oils in Diesel engines. In his opinion only coking tests gave reliable indications of the production of carbon in internal combustion engines. The so-called carbon in internal combustion engines was really not carbon, but a highly polymerised hydrocarbon or asphalt.

SOCIETY OF GLASS TECHNOLOGY.

The fortieth meeting of the Society of Glass Technology was held at the University, Sheffield, on January 19, Dr. M. W. Travers presiding.

The first paper, which was read by Prof. W. E. S. Turner, was by John Currie on "The Rate of Change of Glass Composition in a Tank Furnace following a Change in the Batch Composition." The tank furnace in question had a deadweight capacity of 106 tons, and was charged every 2 hours during six working days by the addition of 30 cwt. of batch and 4 cwt. of cullet. As it was desired to produce a bottle glass of lower melting point and slower rate of setting, the batch was altered so as to reduce the content of lime and alkali; and it was found that nearly three months elapsed before the composition of the glass produced was nearly identical with that calculated from the new batch.

The following two papers were then presented together by Prof. Turner:—(*a*) "Problems arising in Tank Furnace Practice through Shortage of Salt Cake": W. E. S. Turner; and (*b*) "The Relative Advantages and Disadvantages of Limestone, Burnt Lime, and Slaked Lime as Batch Materials": F. W. Hodkin and W. E. S. Turner. (*a*) Various substitutes for salt cake had been tried with success; in some cases one-half to two-thirds had been replaced by soda ash. Mr. Gelstharp, chemist to the Pittsburgh Plate Glass Co., had reported that a good clear glass, having more than a certain lime content, could not be made from a batch in which all the salt cake was replaced by soda ash. Among the advantages claimed for soda ash were:—(1) It was usually purer than salt cake; (2) a considerably greater proportion of its weight remained in the glass; (3) a soda-ash batch melts more readily than a salt-cake batch; (4) soda ash was usually transported more carefully by the railways; and (5) it had been stated that salt cake acted more corrosively on the refractory materials of the furnace. The relative prices of these two materials had, of course, to be considered. (*b*) The effects of limestone, burnt lime, and slaked lime had been tried in both salt-cake and soda-ash batches and in a batch containing a mixture of these. The form of the lime used had a considerable influence; but other factors were also operative. The higher cost of burnt lime was to some extent offset by the elimination of organic matter, which acted as a reducer in the tank and gave rise to glass of poor colour; *per contra*, it was difficult to handle, and it readily absorbed moisture and carbon dioxide. The use of limestone made the batch more expensive, but the gas it evolved helped to agitate the glass and thus produce greater homogeneity.

CORRESPONDENCE.

THE PROPOSED NEW REGULATIONS FOR CHEMICAL WORKS.

Sir,—The projected new regulations for chemical works issued by the Home Office (*cf.* J., 1920, 16 R) are, as a whole, reasonable and progressive. They are designed to protect the workman whilst following his employment from poisonous and other deleterious substances which advancing science has shown to be inimical to his health, and at the same time to compel employers to maintain such a reasonable standard of "welfare" work and good hygienic conditions of employment as the spirit of the times now regards as essential. Many of the details however, will require adjustment or slight rewording. The regulations regarding rescue appliance, working in offensive places, change of clothing, mess rooms and washing facilities, first-aid and ambulance room, drinking-water supply, are all to the good, and their provision will necessitate little or no expense to modern works, since they are already installed in most of them; and any provisions against poisoning by arseniuretted hydrogen are undoubtedly welcome.

The provision of bath accommodation (Regulation No. 15) has always been a disappointment to the progressive employer, as where installed, it has not been used to any extent by the worker. The provision for flooding and drenching with cold water persons splashed with dangerous corrosive liquids (No. 16. (a) I.) is new, but would appear to be already covered by the provision of fire water-buckets throughout the works. Facilities for sitting down (No. 21) will, no doubt, meet with considerable opposition, as such provision can be so readily abused.

Regulation No. 29 prescribes that chlorate shall be crystallised, ground, and packed in a room or place set apart for the purpose, the floor of which must be smooth, made of impervious and incombustible material, such as cement, and be washed or sprinkled with water and swept daily. No. 31 (*b*) provides that all persons employed in such a room or space shall wear boots or overshoes having no metal in them, and woollen clothing, which shall not be removed from the works for any purpose, and which shall be washed daily after use and thoroughly dried before being worn again. These regulations are very severe and go further than experience has demonstrated to be necessary. The washing or sprinkling with water of the floor is really an additional source of danger —daily sweeping is the greatest safeguard. Regulation No. 5, dealing with precautions to be taken against fires, should be amended so as to enable employers to summon workpeople before magistrates for infringing the regulations.—I am, Sir, etc.,

T. T. Best.

Manchester, January 11, 1921.

ORIGIN OF THE SOCIETY OF CHEMICAL INDUSTRY.

Sir,—As from time to time erroneous statements are made concerning the locality and the circumstances in which the Society of Chemical Industry was founded, and as a little knowledge of the Society's origin may prove interesting and useful, particularly to the younger generation of chemists, I have pleasure in sending you the following few recollections of those early days.

The Society of Chemical Industry, with its "nearly 6000 members" and the best Chemical Journal in the world, grew indirectly out of the Faraday Club, the members of which were chiefly works chemists in St. Helens. The Faraday Club held its meetings usually at Mrs. Boothby's, in Lime Street, Liverpool, occasionally in Widnes and Warrington, and later on in the North-Western Hotel, Liverpool. The Widnes men apparently grew somewhat jealous of the success of the Faraday Club, and determined to have a bigger society of their own. Mr. John Hargreaves (a younger brother of James Hargreaves of "saltcake" fame, and of the Hargreaves-Bird electrolytic soda process) accordingly sent out invitations to a meeting to be presided over by Mr. James Muspratt (a brother of E. K. Muspratt, the fifth President of the Society), at the Officers' Room, Drill Hall, Widnes. The Faraday Club members were invited to this meeting; they attended in force and managed to get the secretary (the late Mr. George E. Davis) and treasurer (myself) and another member appointed on the committee to draft the rules for the new society. Mr. G. E. Davis suggested that the Society should comprise the chemists of Widnes, St. Helens, Runcorn, Cheshire, and S.W. Lancashire. Somebody else—probably Mr. James Muspratt—proposed that the next meeting should be held in Manchester, and that Dr. (the late Sir Henry) Roscoe be invited to preside.

At the Manchester meeting a good deal of discussion took place about the name of the Society, many being in favour of making the engineering side more prominent. Mr. G. E. Davis proposed that the meetings be held alternately in London and the provinces, and I suggested that the Society should be co-extensive with the English-speaking world, with branches or "sections" in the chief chemical centres of England and America. This was carried, and the name finally adopted was "The Society of Chemical Industry." The first general meeting was held in London in 1881, in rooms kindly lent by the Institution of Civil Engineers, and was presided over by Dr. Roscoe.

If I were asked to name those who worked hardest to found the Society, I should certainly say Mr. G. E. Davis, who at the time of the formation of the Faraday Club, in 1875, was chemist at Messrs. Gamble, Gerard's Bridge Alkali Works (afterwards one of H.M. Inspectors of Alkali Works and subsequently editor and proprietor of the *Chemical Trade Journal*). He was the Hon. General Secretary of the Society and a vice-president. I used to chaff him about being like the Irishman, who was "never happy unless he was fighting"; and he certainly "built better than he knew." After him I should name the late Mr. Thomas Tyrer, whom I suggested would make a good Metropolitan Secretary (*cf.* his speech at Leeds, J., 1905, p. 722); and Dr. Roscoe, who became the first President.—I am, Sir, etc.,

Douglas de L. Herman.

Manchester, January 11, 1921.

PERSONALIA.

Sir James A. Walker has been nominated by the Council of the Chemical Society to succeed Sir James J. Dobbie as president.

Dr. J. N. Pring, reader in physical chemistry at Manchester University, has been appointed head of the physical chemistry branch of the research department at Woolwich Arsenal.

The Perkin Medal for 1921 has been awarded by the American Section of the Society of Chemical Industry to Dr. W. R. Whitney, director of the research laboratories of the General Electric Co.

The following appointments have been made by the Secretary for Mines:—Chief Inspector of Mines, Mr. T. H. Mottram; Deputy Chief Inspector, Mr. H. Walker; Divisional Inspector of Mines, Mr. J. Masterton; Senior Inspector, Mr E. H. Fraser.

The following have been elected officers of the Council of the American Chemical Society for 1921: President, Prof. Edgar F. Smith; Directors, Messrs. G. D. Rosengarten and H. P. Talbot; Councillors, Messrs. H. E. Howe, C. L. Alsberg, Allen Rogers, and Lauder W. Jones.

Dr. F. G. Cottrell has resigned the directorship of the Bureau of Mines and has become chairman of the Division of Chemistry and Chemical Technology of the International Research Council. His post at the Bureau of Mines has been filled by the appointment of Mr. H. Foster Bain, mining engineer, and formerly assistant director of the Bureau.

The John Fritz gold medal has been awarded to Sir Robert Hadfield for his invention of manganese steel. The medal was first given in 1902, in honour of Mr. John Fritz, ironmaster, of Bethlehem, Pennsylvania, and the award is made by a committee representing the leading American societies of civil, mechanical, metallurgical, and electrical engineers.

Dr. Henry Peile, late chairman of the Newcastle Section of this Society and chairman of the Newcastle Alloy Co., Ltd., has been appointed a Commander of the Order of the British Empire (C.B.E.) for services rendered in connexion with the war. The same honour has been conferred upon Major Sir Douglas Mawson, Head of the Explosives and Chemical Section, Foreign Trade Department.

We regret to record the death, on January 15, from sudden heart seizure, of Mr. Charles Simmonds, who had served for many years in the Government Laboratory, where he was recently promoted to the grade of Superintending Analyst. Mr. Simmonds was a chemist of wide experience; after serving in the Crown Contracts branch of the Laboratory, he was specially engaged first on steel (in connexion with the old Steel Rails Committee) and then on pottery glazes. More recently he had been working on the industrial uses of alcohol, and his work on this subject was published about a year ago, and reviewed in these columns (*cf.* J., 1920, 46 R).

NEWS AND NOTES.

FRANCE.

Industrial Notes.—*Chemical Industry.*—Owing to German competition and a general lull in demand, the situation in the chemical market remains unsatisfactory, and prices in general are falling slowly. Heavy chemicals are not materially affected by the present slump, but there are very few inquiries for special products used in dyeing and bleaching, and for textiles, soap, rubber, and plastic materials. Whereas France formerly obtained heavy chemicals from Germany, she is now sending them to that country and buying finished products instead. French buyers are obtaining indispensable chemicals from Germany rather than England, and the Government has been criticised on this account. The production of calcium carbide is still insufficient, but is to be increased by the erection of a new factory near Ugines, where 32,000 h.-p. is available from the waterfalls of the Doron; the electric steelworks "Paul Girod" is undertaking its establishment.

Minerals and Fertilisers.—The exportation of bauxite, hitherto prohibited, is now allowed to a limited extent to England and America, on payment of a duty of 25 per cent. *ad valorem*, the object being to improve the rate of exchange.

Florida phosphate has reappeared on the French market, doubtless owing to the fall in freights. In some quarters it is held very strongly that such foreign material ought not to be imported, and that France should derive supplies from her own North African colonies; yet some superphosphate works have had to close down from shortage of raw material. The tardy development of the phosphate beds in Algeria and Tunisia is variously ascribed to shortage of freight, of labour, and lack of railway material, but the true cause is probably lack of organisation at the mines. An agreement has been made to supply Italy with 500,000 tons of phosphate yearly in return for 8000 t. of pyrites and a certain amount of labour.

Opinion in Alsace is against the Government scheme for working the potash deposits, by which exploitation would be carried out by four companies; it is held that the State should do the work, that all the employees engaged in the industry should have a share in the profits, and that farmers should be granted priority in regard to supply and favoured terms as regards prices. Such concentration, it is thought, would be the best means of fighting German competition, which is expected to become very severe.

It is reported that petroleum fields have been discovered close to the French frontier in Spanish Morocco.

Metallurgy.—The general situation in 1920 was little better than that during the last six months of 1919; the same factors—shortage and high price of coal, transport difficulties, and high railway rates—continued to impede production, and hence the rolling mills were unable to quote definite prices or dates of delivery. The steelworks outside the invaded area have attained 70 per cent. of their pre-war monthly output, but the restored Lorraine works only 41·1 per cent. The total production of steel during the first six months of 1920 was 1,204,701 tons, and that of pig-iron 1,358,856 t., including 1,325,937 t. made in the blast furnace and 32,919 t. in the electric furnace.

The Comité des Forges de France, on the occasion of its fiftieth anniversary, has published an interesting work on "La Sidérurgie Française," in which, among other points, the prospects of the French iron and steel industry are discussed. It is estimated that when the devastated works of northern and eastern France are in full working order the French production, including that of the Saar district, will be 11 million tons of pig-iron and 10·4 million tons of steel, or, in the event of the Saar district being restored to Germany in fifteen years' time, 9·4 million tons of pig-iron and 8·1 million tons of steel. In 1913 production and consumption were approximately equal, viz., 5·2 million tons of pig-iron and 4·8 million tons of steel. As Lorraine and the Saar do not absorb their own production, it follows that after pre-war conditions have been established and the wants of the devastated areas fully met, there will be a good surplus available for exportation.

At the moment German competition in the metallurgical market is very active, and quotations from Germany are frequently 50—70 per cent. below the French. The reduction in the price of metallurgical coke from 175 to 135 francs per ton will enable French producers to bring their prices more into line with those of their competitors, although the latter have a decided advantage as regards price of coal and labour.

BRITISH INDIA.

Fermentation Industries.—In India, as in other countries, attention is being directed to the possibility of producing alcohol for power purposes, and the Bombay Government proposes to erect an experimental distillery. As it is, of course, undesirable to use foodstuffs for this purpose, the choice of raw materials is considerably restricted. Alcohol for burning and for industrial purposes has been manufactured on a considerable scale from the *mahua* (or *mowa*) flower, which contains a large proportion of lævulose, but the supply of this material is not very great, and the cost of collection would become serious if the scale were enlarged. The possibility is being considered of obtaining alcohol from the rice straw and husk which are available in large quantities in Burma, and especially at Rangoon, where the principal rice mills are situated.

At Nasik, in Western India, a Government factory of considerable size has been erected for the manufacture of butyl alcohol and acetone by the Weizmann process. Nasik was selected as the locality because it is a good centre for *mahua* in spite of the fact that mahua had never been used for this process. It has now been found that the most advantageous raw material is low-grade rice, unfit for human consumption, from the Rangoon rice mills. This is now being utilised with technical success, but it is doubtful whether a commercial success can be achieved because the cost of the factory was very high.

CANADA.

Glass Production.—The Canadian Libby Owens Sheet Glass Co., Ltd., is about to erect a plant at Hamilton, Ontario, with a capacity equivalent to 65 per cent. of the total Canadian importations of sheet glass. All the raw materials will be of Canadian origin, *e.g.*, soda ash from Amherstburg, salt cake from Hamilton, and silica from Cayuga, etc. It is proposed to erect another plant to supply the Western Provinces.—(*Ch. of Comm. J., Dec.* 31, 1920.)

Maple Sugar.—The maple sugar industry has expanded considerably during recent years, particularly in Quebec, where the production in 1920 was about 13,393 long tons, as against 4911 t. in 1911. Similarly, the output in Ontario was 3125 t., compared with an average for previous years of 2232 t.; in Nova Scotia and New Brunswick, the only other provinces producing maple sugar, the production was, roughly, 223 t. The exports of maple sugar also show an increase, the total in 1919–20 being 1788 t., which compares with 653 t. in 1914–15.—(*Official.*)

Discovery of Silver.—It is reported that extensive deposits of silver have been discovered near Keno Hill, in the Yukon territory, and it is hoped that their exploitation will compensate for the declining production of gold.—(*Official.*)

UNITED STATES.

The Dye Industry and the Longworth Bill.—Dye manufacturers in the United States have had to face a similar crisis to that which recently threatened British manufacturers, and they are looking forward to the speedy enactment of the Longworth Bill, which passed the House of Representatives in September, 1919, but has since been held up by the Senate. The Bill provides that only such dyes shall be imported as are not made in the country "in adequate quantity, of good quality, and at reasonable prices." It was primarily intended that the Act should be administered through a joint committee of producers and consumers, but it was subsequently decided to entrust this work to the Tariff Commission. After conferences between this Commission and the Senate Committee on Finance, it was agreed to publish a list of dyes which might be imported in order to avoid inconvenience to the consumer. The Senate Committee reduced the higher tariff rates proposed in the Bill, thus making the embargo less rigorous, and in this amended form it recommended the Senate to adopt the measure. However, when the Bill came before the Senate last spring it was "talked out" by its opponents.

The American Chemical Society has issued a bulletin urging strongly that the Bill be considered and passed without delay. Among the arguments advanced are, (1) a self-contained and independent dye industry is a strong weapon for national defence; (2) large quantities of German dyes are now coming on the American markets; (3) the development of the home industry is being crippled by the uncertainty of legislation; projected extensions of plant have been postponed, research staffs reduced, and much of the capital invested in laboratory plants and apparatus ($100,000,000) remains unremunerative. Further procrastination is condemned not only by the large dye firms, but also by the small manufacturers, on behalf of whom it was declared in the Senate that they would be the first to go under in the price war which would ensue if adequate legislation were not enacted. The home dye industry is now able to meet 85 per cent. of the needs of the country; the remaining 15 per cent. includes the special dyes which only a fully developed industry can be expected to produce.

The Dye Industry in 1919–20.—According to a report issued by the Bureau of Foreign and Domestic Commerce, the United States now possesses a dye industry capable of meeting all home demands. The tendency to consolidate American dye enterprises has not only increased consumption but also developed foreign trade. The value of the aniline dyes exported during the year ended June 30, 1920, viz., $17,130,397, represented an increase of 68 per cent. over that of the previous year. Imports of alizarin and alizarin dyes amounted to 115·1 tons ($103,266), compared with 5·3 t., valued at $13,286, in 1918–19, practically all of which was derived from the United Kingdom; it is reported, however, that one of the largest American makers can now supply certain alizarin colours. Imports of other finished coal-tar dyes rose from 863·4 t. ($2,753,116) to 1224·1 t. ($3,775,216), or an increase of 44 per cent. Switzerland has replaced Germany as the chief source of imported coal-tar colours; the United Kingdom supplied 275·3 t., worth $609,238, in 1919, and 249·1 t., worth $567,258, in 1920. Imports of natural indigo declined from 444·6 t. ($1,242,855) in 1919 to 56·5 t. ($165,332) in 1920, but that of synthetic indigo increased from 265·2 t. ($308,582) to 452·7 t. ($530,285); it is considered unlikely that natural indigo will be able to compete with the synthetic product. Owing to the need of statistical data concerning the foreign trade in coal-tar colours, a new import classification has been drawn up which takes effect as from January 1, 1921.—(*Bd. of Trade J., Dec.* 9. 1920.)

Sodium Compounds in 1919.—The total production of manufactured sodium compounds was 9,393,749 short tons, valued at $121,204,219 in 1919, compared with 10,199,493 t., worth $142,788,535, in 1918. Of sodium salts derived from natural sources 7,093,138 t. was produced in 1919, against 7,262,797 t. in the previous year. Imported sodium salts showed a very great decrease, viz., 522,356 tons, compared with 2,111,725 t. in 1918, but imports of sodium cyanide, ferrocyanide, and sulphide notably increased. The exports, valued at $18,545,420, consisted chiefly of common salt (119,416 t.), caustic soda (82,118 t.), soda ash (50,481 t.), washing soda (5,563 t.), and sodium silicate (12,150 t.); those of soda ash decreased greatly, but that of caustic soda increased. The substitution of sodium compounds for potassium compounds, initiated during the war, continued during 1919.

Production of sodium and sodium compounds in the United States in 1919.*

	Quantity Short tons
Sodium acetate	2426
Sodium benzoate	126
Sodium bicarbonate	134,962
Sodium bichromate	26,526
Sodium bisulphite and sulphite	11,846
Sodium bromide	499
Sodium carbonate—	
Soda ash	981,054
Monohydrate and sesquicarbonate	30,796
Sal soda	80,090
Sodium chlorate and sodium perborate	1210
Sodium chloride—	
Salt in brine	2,809,000
Rock salt	1.637,300
Evaporated salt	2,618,200
Sodium citrate, tartrate, bitartrate	33
Sodium cyanide, peroxide, iodate	9148
Sodium ferrocyanide	3437
Sodium fluoride, acid sodium fluoride, sodium fluosilicate	811
Sodium hydroxide (caustic soda)	355 466
Sodium iodide	12
Sodium nitrate (refined)	8040
Sodium nitrite	676
Sodium phosphate (including all sodium phosphates) ..	14,760
Sodium silicate	300,138
Sodium sulphate—	
Salt cake	134,685
Glauber's salt	42,087
Nitre cake	83,402
Sodium sulphide	45,448
Sodium tetraborate (borax)	28,518
Sodium thiosulphate (hyposulphite)	32,212
Miscellaneous sodium compounds	841
Total ..	9,393.749

* For production in 1917 and 1918 *cf.* J., 1920. 8R.

In the above returns the production of sodium cyanide is combined with that of peroxide and iodate in order not to reveal the production of individual firms. Sodium cyanide is now being supplanted by a product, presumably calcium cyanide, made by heating calcium cyanamide with salt to a high temperature and quickly cooling the melt. The reaction is conducted continuously in electric furnaces with conducting hearth and a single suspended electrode; it is used directly in the extraction of gold and silver and for making sodium ferrocyanide and hydrocyanic acid.

The production of caustic soda given in the table does not include that made in soap works. Many pulp and paper mills also make caustic soda for their own use.—(*U.S. Geol. Surv., Nov.* 16, 1920.)

Foodstuff Preservation with Condiments.—The Glass Container Association of America has published a monograph by K. G. Bitting on the "Effect of Certain Agents on the Development of Some Moulds," in which the observations of some fifteen years are recorded. The work has special reference to the use of spices or other condiments as preservatives for foodstuffs, and in addition to containing numerous tables, it is profusely illustrated with photomicrographs showing the effect of many materials upon typical moulds.

New Use for Mercury.—The utilisation of mercury vapour for the production of power is being investigated in the United States, the object being to increase the range of temperature through which the heat from the fuel may be converted into power. The mercury is vaporised in a special boiler at about 10 lb. gauge pressure and used to drive a turbine. The exhaust from this turbine is condensed in a form of surface condenser, which produces steam from the cooling water, and the steam is utilised to drive another turbine, the condensed steam in this case being used as cooling water for the mercury condenser. It is claimed that the use of this device in a modern power station would increase the capacity by about 60 per cent., while increasing the fuel consumption by only 15 per cent., and trials with over a 1000 k.w. on the mercury turbine are stated to have fully realised the economies predicted.—(*Power, Oct.* 27, 1920.)

SOUTH AFRICA.

Mineral Output in 1919.—The Annual Report of the Secretary for Mines and Industries, 1919, gives the mineral production for that year and for 1918 as follows:—

	1919. Tons.	1918. Tons.
Coal	10,266,135	9,877,325
Copper	4,885,319	6,874,859
Tin	1,630,168	2,206,042
Antimony	32,000	99,055
Arsenic	8,120	17,785
Lead	756,000	161,600
Manganese	155,000	544,250
Tungsten	*4,469	18,880
Asbestos	3,932,077	3,674,053
Corundum	178,587	3,875,526
Graphite	85,511	78,974
Iron pyrites	5,532,234	4,630,000
Magnesite	1,024,000	832,500
Mica	2,951	5,089
Mineral paints	239,809	735,556
Soda	52,050	764,340
Talc	756,750	670,250
	Fine oz.	Fine oz.
Gold	8,331,651·142	8,418,379·029
Silver	891,303·635	877,522·147
	Carats.	Carats.
Diamonds	2,588,017·06	2,537,360·16

*Mostly contained in other ores.

The low-grade gold mines on the Rand are stated to be in a serious position, and labour troubles are reducing the output of the more productive properties. Attention is now being concentrated on base metals and minerals, such as iron ores, asbestos, corundum, mica, and, to a lesser extent, salt, lime, gypsum, soda, magnesite, and graphite. —(*Bd. of Trade J., Jan.* 6, 1921.)

JAPAN.

The Dye Industry.—The U.S. Bureau of Foreign and Domestic Commerce has received information from Tokyo to the effect that the Japanese dye industry cannot compete with German or American manufacturers, even with the help of the new import duty of 35 per cent., owing to lack of technical skill in their production and of a home supply of intermediates.—(*U.S. Com. Rep., Nov.* 23, 1920.)

Imports of Dyestuffs in 1920.—Since the end of the war the new Japanese dyestuffs industry has suffered to such an extent from the revival of European competition, that in March, 1920, 72 works, or 65 per cent. of the whole industry, had to close down. Concurrently the importation of dyes rose from 130 tons in January to 262 t. in May, and fell during the industrial crisis in June to 165 t., the total for the six months ended June, 1920, being 1025 t., as against 226 t. in the same period of 1916. The imports of European and American dyestuffs have steadily increased since 1916, although there was a large decrease in 1917. The average price of dyestuffs in Japan in 1920 was 4·75 yen per kin (9s. 8¼d. per 1·32 lb. at par value).—(*Z. angew. Chem., Dec.* 24, 1920.)

AUSTRALIA.

The Iron-Ore Deposits at Yampi Sound, Western Australia.—The Queensland Minister for Mines announces that his Government has decided to exercise the option of purchase which it holds over the vast iron-ore deposits in Cockatoo Island, Yampi Sound (*cf.* J., 1920, 218 R), with a view to establishing State iron and steel works in Queensland. The Minister stated that the opinion of the manager of Messrs. Armstrong, Whitworth and Co. (Mr. Cooper) was that the manufacture of steel from ore as rich as that at Yampi would be extremely easy.—(*Official.*)

Gold Mining, etc., in Western Australia.—The Imperial Mineral Resources Bureau reports a noteworthy development on the abandoned Golden Dream lease, about one mile north of Hannan's Reward mine, Western Australia. An auriferous lode has been struck and driven on for 60 ft. over an average width of 2 ft. 6 in., and a trial crushing gave 95 oz. of gold from 88 tons of rock, with 5 dwt. per ton in the sands.

The production of gold at State Batteries since the date of inception to August 31, 1920, has now reached a total value of £5,230,839, made up as follows:—Tons of ore milled, 1,266,431·69; production by amalgamation £4,379,655·52; by sands treatment £634,354·64; by slimes treatment £207,475·47; and by residues £9353·37. In addition, the State tin-treatment plants have produced by black tin £92,120·93, and by residues treatment £572·32, making a total mineral value from all sources of £5,323,532·25.

GENERAL.

Research in the Brewing Industry.—An editorial in the current issue of the *Journal of the Institute of Brewing* expresses regret that the activity in brewing research which marked the halcyon days of O'Sullivan, Horace and Adrian Brown, Heron, and Morris, has not been sustained in recent years, and ascribes the lack of progress mainly to the restrictive influence of State supervision. The fact that the brewing and distilling industries are valuable sources of revenue to the State hampers initiative, stereotypes processes, and fosters empiricism at the expense of scientific advance. The Amylo process of alcohol production, for example, is not permitted in this country because of a statutory regulation which prescribes that the strength of distillers' worts before fermentation must be ascertained by the saccharometer, a method which is not practicable in the process named.

In order to promote and develop organised research, the Institute of Brewing has drawn up a comprehensive scheme, and has succeeded in raising a capital sum which will allow of £5000 per annum being devoted to this purpose. Investigations on the breeding and cultivation of hops have been undertaken at the South-Eastern Agricultural College at Wye and at the Malling Fruit Research Station, whilst experiments on the drying of hops and on the effect of manurial treatment on their growth have been made possible by the generosity of private donors. Concomitantly with these researches Prof. F. L. Pyman, at the Manchester College of Technology, is to investigate those constituents of the hop which determine its preservative and antiseptic properties; and work on barley is also to be taken in hand. Arrangements have been made for the investigation of the suitability of various species of oak for cask-making (supplies from Memel being no longer available) at the Imperial College, South Kensington, where Prof. F. B. Schryver and Prof. P. Groom will attack the problem from the chemical and botanical sides respectively. The Institute has also made due provision for the encouragement of research by individual private workers.

The Science of Nutrition.—The Huxley Lecture delivered by Prof. Gowland Hopkins at Charing Cross Hospital Medical School on November 24, 1920, was devoted to a review of the striking modifications which the theories of animal nutrition have undergone during the last twenty years.

At the close of last century the problems of human nutrition were being more and more regarded from the standpoint of energetics, and dietaries were usually considered solely on the basis of nitrogen content and calorific value. Although it is true that many of the foundations of the science of nutrition were laid by investigators who regarded the problems they attacked in this manner, there was a tendency on the part of many to carry this conception too far and to neglect the influence of other factors. Rubner, to whom we owe so much of our knowledge of the energy requirements of the animal body, was led away in this manner, and gradually developed a theory which disregarded, in one sense, the significance of the chemical composition of the diet and the material changes which occur in the body, and gave sole prominence to the calorific values of the constituent foodstuffs. The law of Isodynamic Equivalence, propounded by Rubner, states that the living tissues demand energy alone, and from his works one infers that considerations of energy exchange are alone adequate to explain such phenomena as growth, body size, and length of life. It does not require a very deep examination of his views to show how misleading they may be, and, indeed, have been. If fat and carbohydrate are interchangeable as sources of energy for the animal tissues, as follows from Rubner's law, it should be possible to derive the whole energy supply from a dietary of fat. Such an extreme case is one of the many examples where the theory fails, for it is well known that such a diet causes a definite breakdown in the internal metabolism of the body with the production of the abnormal condition known as ketosis.

Closely following the theories of Rubner we have the system of nutrition introduced by Prof. von Pirquet, of Vienna, who evaluates dietaries in terms of a unit called the "Nem," which is the energy supplied by the combustion of the constituents of 1 c.c. of milk. Here we have a practical system in which the chemical details of the diet are disregarded, and yet one which is being employed on a large scale to-day in Central Europe in the organisation of the relief feeding of nearly a quarter of a million children in Vienna on behalf of the Red Cross organisation. Such systems as these are now being vigorously attacked by investigators, mainly of the English-speaking races, who hold that the chemical composition of the diet is as important as the calorific intake. It is now established that the character of the protein supply is all important to the animal body, and that the biological value of the proteins may show wide variations, which can be traced to their content of certain indispensable amino-acids. Further, the discovery of the vitamins and recent work in this wonderfully interesting field of research have demonstrated that nutrition and health may fail even when an animal is consuming a dietary adequate as regards protein, calories, and salts unless ample supplies of these unidentified accessory factors are present. Rubner and his followers would regard energy supply as the one essential limiting factor in nutrition, but it must now be recognised that there are many factors which may act in this manner. In this country and America there remain few who do not acknowledge this to be true, but in Central Europe the older theories still hold their ground. They are, however, being attacked in a manner that promises to demonstrate their inaccuracy. Dr. Harriette Chick and Dr. Elsie Dalyell, under the auspices of the Lister Institute and the Medical Research Council, are now in Vienna, where in two adjacent wards of the hospital of von Pirquet the new theories are being tested against the "Nem" system under rigidly controlled parallel conditions. As Prof. Hopkins remarked, "the enterprise is unique in its occasion, in its international character and in the high qualifications of those who are conducting it." One cannot help foreseeing that this experiment will show how important to practical medicine are recent advances in the science of nutrition.

The Sweetness of Saccharin.—The sweetening powers of saccharin and of its hydrated sodium salt are conventionally accepted at the fixed values of 550 and 420, respectively, compared with that of refined beet sugar, but recent investigations by Prof. Th. Paul have shown that the sweetness is dependent upon the concentration of the saccharin solution tested; it increases at a slower rate than the concentration. Thus the sweetness of the sodium salt (in concentrations corresponding to 2—10 per cent. sugar solution) was found to vary between 200—700 times that of sugar, and not to be 420 times, as generally accepted. It was also found that the sweetness of an aqueous solution containing saccharin and other artificial sweetening agents was approximately equal to the sum of the sweetening powers of the constituents. These results should assist those concerned in estimating the amount of sweetening agent required for any particular foodstuff.—(*Schweiz. Chem.-Z., Nov.* 30, 1920.)

Proposed Drug Monopoly in Sweden.—There are grounds for believing that the Swedish Government intends to create a monopoly in the manufacture of pharmaceutical preparations, and possibly also to nationalise the whole industry. According to the present law, the manufacture of medicinal preparations by druggists is restricted to that of certain articles, but in recent years almost all descriptions have been manufactured in a large number of private laboratories, and effective control has been completely lacking. It is provisionally planned that a new central institution shall take over all existing privately-owned works, but that individual pharmacists shall be free to manufacture for themselves or to purchase from the institution. Owing, however, to the superior economy of large-scale production, it is considered certain that in nearly every case druggists will be driven to adopt the latter course. The institution mentioned will be established by a new subsidiary company of the Wine and Spirit Central Organisation in Stockholm, which will have a capital of 5 million kroner (£281,250 at par), and every Swedish pharmacist will be summoned to take shares, the Central Organisation retaining a majority. The works of the A.B. Astras Fäbriker in Söderfälje will then be acquired and manufacture proceeded with. Finally, an opportunity will be given to the State to acquire a controlling interest in the undertaking.—(*Chem. Ind., Nov.* 17, 1920.)

The Porcelain Industry in Norway.—All porcelain used in Norway for technical purposes formerly came from Germany, but war conditions gave the spur to the development of a home industry. The Norsk Teknisk Porzelänsfabrik, Frederikstad, is now in a position to supply technical porcelain ware in great variety, more particularly electrical insulating ware, and to hold its own against foreign competition. The company was formed during the war, began to produce regularly in November, 1919, and now commands a capital of 1·1 million kronor (about £62,000 at par). Norwegian felspar and quartz, and German kaolin are the raw materials employed, and as the factory has ready access to the harbour, transport arrangements are very favourable. It is candidly admitted in Norway that the installation and manufacture would have been impossible but for the help of German technologists and workpeople, who have been employed since the beginning. German labour is used for all difficult work, and the technical director is a German who for a long time held a prominent position in a leading German factory.—(*Z. angew. Chem.*, *Dec.* 10, 1920.)

Cost of a German Degree Course in Chemistry.—The present cost of a four-year course (eight semesters) in chemistry is estimated to be about 6000 marks (about £300 at par, now £22—27), exclusive of the cost of materials required for the "Doktorarbeit," and of the fees payable upon graduation (500 mk.). The cost is distributed as follows:—First semester, lectures 250 mk., books 200 mk.; second semester, lectures 250 mk., books 100 mk.; third semester, qualitative analysis, practical physics, etc., 400 mk., materials 450 mk.; fourth semester, qualitative and quantitative analysis, practical physics, etc., 400 mk., books 100 mk., materials 400 mk.; fifth semester, quantitative analysis, special and general lectures, organic preparations, 350 mk., books 150 mk., materials 700 mk.; sixth semester, organic chemistry 350 mk, books 100 mk., materials 700 mk.; seventh semester, "Doktorarbeit," rougbly 300 mk.; eighth semester, 300 mk. Thus the cost of University fees is about 2600 mk., books 650 mk., and chemicals, apparatus, etc., 2250 mk.—(*Chem.-Z.*, *Nov.* 13, 1920.)

Chromium Ore in Russia.—The chief deposits of chromium ore in Russia are on the eastern slopes of the Ural mountains, and although little is known about them, their large number and their proximity to metallurgical centres should lead to development when conditions permit. There are no data available concerning production, but it is known that ore has been obtained from 20 or 30 small mines by means of primitive methods. Chromium ore is stated to occur in abundance on the north-east shores of Lake Koktcha, Government of Erivan, Transcaucasia, and also along the Gazimur River, near the Kultuminsk silver-lead mines in Transbaikalia.—(*U.S. Com. Rep.*, *Sept.* 20, 1920.)

Possible Sources of Wood-Pulp in Chile.—The utilisation of the timber resources of Chile should receive increased attention as the more accessible wood-pulp material ceases to be available. Analysis of certain woods and reeds by the soda process has given the following results:—*Olivillo* gave 38 per cent. of a dark pulp, difficult to bleach, but quite suitable in its unbleached state for the manufacture of wrappings. The average length of the fibre was 2·15 mm., and a sheet 0·0044 in. thick showed a bursting strength of 23 lb. per sq. in. *Coigue* yielded 42 per cent. of a pulp readily bleached; the fibres were short (0·86 mm.), but in conjunction with sulphite pulp it could be used for the production of printings. *Lingue* closely resembles Coigue, but gives slightly longer fibres (1·11 mm.). *Quilla.*—This reed occurs abundantly and can be harvested annually; it gave a pinkish-coloured pulp with an average length of fibre of 2·22 mm., and could be used unbleached for newsprint. The bleached pulp could be used without the addition of sulphite pulp for the production of light printings. There are other woods said to be equally well or better suited for pulp-making, such as the Araucanian pine, which grows abundantly and rapidly and gives a dark-coloured pulp, with an average fibre length of 2·36 mm.—(*U.S. Com. Rep.*, *Oct.* 22, 1920.)

REPORT.

Report on the Trade, Industry and Finance of Morocco. *Department of Overseas Trade. London: H.M. Stationery Office.* 1920. [*Cmd.* 975. 1*s.*]

The French Protectorate of Morocco has numerous natural resources, many of which are either unutilised or are being developed on an experimental scale. Industry is now developing freely under conditions closely resembling those which existed before the war, and, with the exception of certain agricultural produce, the export trade is unfettered by restrictions. The mineral resources are still undeveloped, but important oilfields and phosphate beds will probably be exploited in the near future. Industrial development, hitherto very backward, has made rapid strides since 1914; factories have been erected for the manufacture or preparation of cement, lime, palmetto-palm fibre, meat and other foods, as well as flax-spinning and olive-oil mills, electrical power stations, and a large modern slaughter-house with by-products factory. Progress is reported in the cultivation of flax, and prospects of producing spun flax and hemp are considered very hopeful; however, with the exception of wool and the palmetto palm, raw materials are not abundant. There has been a great shortage of fuel, and skilled labour is scarce. Exports in 1919 included:—Linseed, 15,680 tons (£840,952), and hides and skins, 3246 t. (£782,783). Imports consisted chiefly of building materials (*e.g.*, cement 3794 t.), cotton textiles, sugar (43,884 t.), candles (3579 t.), soap, kerosene, and gasoline; there is a large demand for cement, glassware, gasoline, kerosene, and coal.

The resources of the Tangiers Zone are confined to agricultural products. There are no railways in the area, but work has been started on a line between Tangiers and Fez. Exports in 1919 were valued at £289,669, including beeswax (£4310), and skins and hides (£192,117); imports were valued at £1,563,650. Great Britain has retained its pre-war predominance in the import trade of many articles, *e.g.*, candles and soap, and has taken the place of France as the chief source of supply of paints, but has lost practically the whole of the trade in vegetable oil to Spain. Good openings are available for British exporters of building materials and window glass, cement, fertilisers, glass and china.

The agricultural prospects of the Spanish Zone of Morocco are good; the palmetto palm is very abundant, and its fibre and leaves are used by the natives for making baskets, mats, etc.; extensive cork oak forests exist in the unpacified areas, and a great future is anticipated for the cultivation of olives. The occurrence of ores of iron, copper, zinc, lead, silver, and other minerals is known with certainty, but adequate surveys of their nature and extent have hitherto been impossible owing to the unsettled state of the country. Three iron-ore and one lead-and-zinc mine are being worked in the Melilla district, the most important of which is the iron-ore mine of the Espanola Minas del Riff company, which has a monthly output of 15,000 to 20,000 tons assaying Fe 63%, SiO_2 5%, and a low phosphorus content. An output of 50,000 tons a month is considered possible. From the Navarette mine of the Setolazar company, 61,000 t. of ore was shipped to the United Kingdom in 1918, and the annual output is expected to reach 150,000 to 200,000 t.; the ore averages 57·5 per cent. of iron, but is rather high in phosphorus. The Alicanta company has produced about 800,000 t. of manganiferous iron ore since 1915; its deposit is superficial, but is estimated to contain up to one million tons of ore with about 55 per cent. of iron. The Afra lead and zinc mine is worked by the Norte Africano company, which has produced a maximum yearly output of 1500 t. of galena. This mineral is of high grade, but non-argentiferous; the zinc ore is calamine with about 32 per cent. of zinc. A new washing and concentrating plant of large capacity has been installed at the mine by a German firm, but has not yet been used. Numerous deposits of iron ore are said to occur in the unpacified zone, and other reported occurrences are lead, copper, antimony, and petroleum. Both the export and the import trade are almost entirely in Spanish hands; in the former England is badly handicapped by absence of direct shipping communications. The exports from Tetuan in 1918 included hides and skins, tanned hides, tamarisk gall, fullers' earth, linseed, virgin wax; and among the imports of British origin in 1918 were ultramarines, perfumery, soap, candles, linoleum; and in 1917 refined sugar, linseed oil, sarsaparilla, varnishes, ochres and ultramarines, perfumery, soap, candles, glass, and matches.

The report contains a large sketch map of the country, appendices giving statistics of trade, revenue, prices, etc., and reports on minerals submitted by the Imperial Institute to the Department of Overseas Trade (*cf.* J., 1920, 382 R).

OFFICIAL TRADE INTELLIGENCE.

(*From the Board of Trade Journal for January* 13 *and* 20.)

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W. 1, from firms, agents, or individuals who desire to represent the U.K. manufacturers or exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department and quoting the specific reference number:—

Locality of Firm or Agent.	Materials.	Reference number.
Australia	Perfumery	80
..	Paint (oxide of iron)	*412/20/7/392
British India	Glass, crockery, porcelain, soap, perfumery	83 83
Canada	Galalith wares	85
..	Paper mill materials	91
..	Soap, toilet preparations	42
..	Heavy chemicals, dyes	43
..	Asbestos card	†
Egypt	Oil, tyres	97
New Zealand	Oils, colours, varnish	45
..	Chemicals, paper	46
South Africa	Mining chemicals	51
..	Toilet soap	95
Belgium	White lead in oil, powdered antimony	58
..	Sole leather	99
..	Industrial oils	100
..	Industrial and pharmaceutical chemicals	102
Denmark	Chemicals, lubricating oils	60
Germany	Fats, oils, grease, tallow	63
Hungary	Chemicals, drugs, indigo, soap, oils, sugar, paper	108
Norway	Tinplate	110
Spain	Iron	113
Switzerland	Colours, paper, lithopone, zinc white, white lead in oil, rosin, linseed oil, turpentine, white spirit, wood oil	114
Japan	Chemicals, dyes, paints, varnish, fertilisers	67
United States	Benzoic acid and salts	70

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* The Official Secretary, Commercial Information Bureau, Australia House, Strand, London, W.C. 2.

† The Canadian Government Trade Commissioner, 73, Basinghall Street, London, E.C. 2.

Markets Sought.—A Canadian firm wishes to dispose of 10,000 tons of fertilisers (ammonia and phosphoric acid compound).

A Canadian company invites applications for quantities of "Stellite" (high-speed steel).

[Inquiries to the Canadian Government Trade Commissioner.]

TARIFF, CUSTOMS, EXCISE.

Australia.—The import of calcium carbide is prohibited except under licence as from Dec. 2, 1920.

The prohibition of the export of pig-iron and manufactures of metals has been revoked.

Egypt.—Among the articles that may be exported without export licence (under certain conditions) are coconuts, sweetened condensed milk, dyes, gold leaf, nuts (except arachis), starch, edible fats, and margarine.

Fiji.—The export of copra is now permitted without licence.

France and Algeria.—The "coefficients of increase" on certain articles have been increased. Articles affected include glucose, chicory, vinegar, aluminium powder, iron shavings, bronze powder, soap, yeast, syrup, certain kinds of leather, and many chemicals and drugs.

Germany.—Among the articles hitherto temporarily admitted duty free which must now pay the prescribed rates of customs duty as from January 1 are vegetable wax, beeswax, spermaceti, copper sulphate, zinc oxide, ammonium nitrate, lead nitrate, casein, certain kinds of leather, dissolved rubber, and soft rubber paste.

Italy.—Certain building materials, including cement, may be imported duty free until June 30, 1922.

Latvia.—Among the articles that may be imported free of restrictions are medicaments, cast iron, steel, copper, white metals, naphtha, engine oil, fertilisers, tanning materials, sole leather, window glass, and industrial chemicals.

Articles the import of which is prohibited include, *inter alia*, beer, gold, silver, bronze, glass and porcelain (with some exceptions), perfumery, toilet soap, yeast, syrup, certain kinds of leather, and certain pharmaceutical preparations.

The import of all other goods is allowed under special licence.

Netherlands.—Export prohibitions have been removed from acetone, bone meal, Chinese wood oil, coal-tar dyes, gypsum, lime, limestone, dyeing woods and extracts, medicines, petroleum, pyrites, rosin, asphalt, shellac, train oil, wood tar, pitch.

Recent customs decisions affect solid fats, diphenylmethane, rubber yarns, bromoform, beta-naphtholmethyl ether, beta-naphtholethyl ether.

Norway.—The prohibition of the export of salt has been withdrawn.

Poland.—Among the articles that may be imported without permits are cocoa, alcohol, albumin, fertilisers, glue, animal fats and oils, wax, skins, certain kinds of leather, cork, certain oil seeds, certain building materials and ceramic wares, tar, pitch, anthracene, benzene, phenol, rosin, asphalt, gums, rubber, many chemicals, ores, metals and metal wares, cellulose, and certain kinds of paper. [The list is very long and is given in full in the issue for January 20.]

South Africa.—Opium and preparations thereof may only be imported under certain specified conditions with the permission of the Secretary for Public Health.

Trinidad.—All goods entitled to preference under the British Preferential Tariff must be accompanied by a certificate of origin. [January 13.]

Tunis.—The import of binder twine and sulphur is now permitted.

Turkey.—The export is prohibited of, *inter alia*, sugar, certain building materials, charcoal, quinine, neosalvarsan, aspirin, gold, silver, and nickel

TRADE NOTES.

BRITISH.

St. Helena in 1919.—Agriculture generally has been much neglected in favour of flax-growing, which is making good progress. There was, however, a short supply of fibre, as small and immature leaves had been harvested to take advantage of the high prices. The output from the Government mill was 40½ t. of fibre and 27 t. of tow, and two private mills produced 410 t. of fibre and 115 t. of tow. Imports and exports were valued at £44,084 and £30,878, respectively, the latter including 603 t. of fibre and tow worth £27,108. The increased area devoted to flax has led to a shortage of foodstuffs, which has had serious consequences. (*Col. Rep.—Ann., No.* 1039, *Aug.*, 1920.)

Turks and Caicos Islands in 1919.—The trade of the Turks and Caicos Islands improved in 1919, the imports being worth £38,343 and the exports £33,554, as compared with £39,276 and £25,594, respectively, in 1918. Exports of salt, valued at £24,117, showed a decline owing to competition from accumulated stocks of salt in the Mediterranean, and lack of freight. Large stocks of salt —over 2 million bushels—were on hand at the end of the year. The cotton exported amounted to 15 bales of lint and 94 bags of seed, worth £580. The development of the production of cotton, said to be of high quality, is promising, as an estate of 8000 acres in the Middle Caicos has been leased to an American company for cotton-growing.—(*Col. Rep.-Ann., No.* 1042, *Oct.*, 1920.)

FOREIGN.

Chemical Trade and Industry in Argentina.—Several chemical factories which were started during the war have had to close down on account of inability to face foreign competition, and, generally speaking, the production of chemicals is small and inefficient.

Three firms manufacture sulphuric acid (53°—66° Bé), using sulphur from Italy (by preference), Chile, and the United States; chemically pure sulphuric and hydrochloric acids are produced, but only commercial nitric acid. In spite of the difficulty of transporting sulphuric acid over long distances through the tropics, local manufacurers do not find it easy to compete with foreign exporters. Acetic acid and vinegar are made in the country, but glacial acetic acid is imported. Two firms are producing, near Cordoba, acetate of lime, lead acetate, acetic acid and acetone by the distillation of wood of the algarrobo tree, but these products have to be marketed at prices higher than those imported owing to the high cost of working on a small scale. Practically no tartaric acid is made in the country, but the possibilities are well worth investigating. There is a demand for both tartaric and citric acids, preferably in the form of crystals. Importations of carbolic, boric, carbonic, hydrofluoric, and tannic acids are small. Imports of alum have declined from an average of 6300 tons in 1913–16 to 490 tons, and are now derived mainly from the United States. Liquefied ammonia is in demand for refrigerating plants, about 540 t. being imported annually, of which 90 per cent. is supplied by the United States. The yearly demand for industrial arsenic is about 250 t., although in 1919 more than double this amount was imported, again mainly from the United States. The demand for calcium carbide has decreased from 9000 metric tons in 1913 to 3000 t. in 1919. Glucose is in great demand, the imports averaging 2100 t. per annum. There is a small but insufficient production of electrolytic bleaching powder, and the annual importation averages 680 t. The imports of other chemicals in 1918 were:—Aluminium sulphate, 1155 t.; alums, 490 t.; anhydrous ammonia, 540 t.; arsenic compounds, 250 t.; boric acid, 55 t.; barium sulphate, 2024 metric tons; copper sulphate, 1740 t.; iron sulphate, 10 t.; magnesium sulphate, 676 t.; glycerin, 110 t.; paraffin wax, 1811 t.; and rosin, 14,100 t. Most of these chemicals are obtained from the United States, but the requirements in sheep and cattle dips, some 7500 t. per annum, are derived almost entirely from Great Britain; stearine, tallow and similar products are obtainable locally. There is a large demand for disinfectants, veterinary remedies, tar oil, carbolic acid, serums, and drugs in general.

The first paper-pulp factory established in the country was expected to start operating in September last. The mill, situated near Barranqueras on the Parana river, and under German-Argentine control, utilises a perennial bog grass known as "paja brava," and has a capacity of three tons of strawboard per day. The plant will in time be increased in order to furnish a larger output of a better quality pulp. There is a good field for the wood-pulp industry in northern Argentina, as there is an abundant supply of suitable raw materials and a ready market for the products.

An Argentine company is now producing on a commercial scale goods made from flax-straw waste. The process used is new, and it is claimed that the product is equal or superior in colour, elasticity, length of fibre, and resistance, to fibres retted by the old methods, which required many days' time, as compared with less than half-an-hour by the new method. The estimated quantity of linseed straw available in Argentine is 5·4 million tons annually, and except for the small amount (25 tons per day) used by the company, the whole of it is burned.—(*U.S. Com. Rep., Nov.* 2, 18, 19, 27, 29, *Dec.* 2, 1920.)

Paraguay in 1919.—The republic of Paraguay has a population of over a million, but the buying capacity for foreign goods is limited to not more than a fifth of this number. Cattle raising, meat packing, agriculture, the production of quebracho extract, and some lumbering constitute the chief industries. Cotton of good quality and sugar are also produced but are not exported. The exports in 1919, worth about £2,963,223, included:—Essential orange oil, 38 metric tons; quebracho extract, 32,876 t.; and 256,958 hides. Argentina and Spain took 56 and 10·8 per cent. of the exports respectively. The imports, valued at £3,167,194, included chemicals, drugs, mineral oils, and paints valued at £161,099, and china, earthenware, and glassware worth £25,002. Of the total imports, Argentina supplied 42·8, England 24·7, and the U.S.A. 17·2 per cent.—(*U.S. Com. Rep., Suppl., No.* 48*a*, 1920.)

Foreign Company News.—*France.*—The capital of the Société Chimiques des Usines du Rhône is to be increased from 3,200,000 to 21,600,000 fr. by the issue of 184,000 new shares of 100 francs each; that of the Cie des Tales de Luzenac from 3 to 5 million fr.; and that of L'Azote Français from 1 to 5 million francs. During the year ended June 30, 1920, the Stéarinerie et Savonnerie de Lyon made a net loss of 385,386 fr., owing to the unsettled state of the market; its capital is now 8,000,000 fr. The Caoutchouc de Sumatra Cie. produced 435 metric tons of rubber during the year ended June 30, 1920, and made a net profit of £10,436; the output of the plantations is to be reduced by 25 per cent.—(*Rev. Prod. Chim., Dec.* 31, 1920.)

Sweden.—The adverse effect of high production costs on the Swedish chemical industry (*cf.* J., 1920, 382 R) is further illustrated by the collapse of the A.S. Norsk Kemikalia of Oesterdalen. This company proposed to produce charcoal, tar, turpentine, wood spirit, and pharmaceutical chemicals, but owing to the excessive cost of construction, wages and raw material, it decided to go into liquidation while its share-capital was still intact. —(*Schweiz. Chem.-Z., Nov.* 9, 1920.)

REVIEWS.

THE DETERMINATION OF HYDROGEN IONS. *By* W. MANSFIELD CLARK. *Pp.* 317. (*Baltimore: Williams and Wilkins Company.* 1920.) *Price, including postage, U.S.A.* $5, *other countries* $5.50 *net.*

A book on the determination of hydrogen ions in the English language should find a welcome among workers in widely dispersed branches of chemical inquiry and application. It was known to the older chemists that numerous chemical processes comprising particularly those of importance to the biological sciences were dependent upon the "degree" of acidity or alkalinity of the media in which they took place, and it was also known that this degree was not amenable to estimation by direct titration, but was conditioned by the strength of the acids and bases present. In all these cases the determination of hydrogen-ion concentration furnishes a quantitative basis of investigation. Starting from the groundwork of the ionic theory, the subject under review, after having been worked out mainly in Ostwald's laboratory, was very greatly developed, especially in its biological applications, in Sorensen's laboratory in Copenhagen, and is now being vigorously prosecuted in its many ramifications, particularly in America.

The author of the present work, who is engaged in the research laboratories of the Dairy Division of the U.S. Department of Agriculture, and has himself contributed notably to the advancement of the subject, has here presented a book which furnishes a complete guide both to the theoretical and the practical side of hydrogen-ion determination. The main contents of the book include:—(1) An introduction, comprising a full theoretical discussion of acid and base equilibria, the p_H scale of acidity and alkalinity, buffer action, etc.; (2) a number of chapters dealing with the colorimetric determination of hydrogen-ion concentration, the theory and application of indicators, the preparation and use of buffer solutions, protein and salt errors, etc.; (3) several chapters dealing with the electrometric method of hydrogen-ion determination, the theory of the hydrogen electrode, potential differences at liquid junctions, the apparatus and technique required for electrometric measurements, the sources of error, the relation of hydrogen electrode potentials to reduction potentials etc.; (4) a chapter on supplementary methods; (5) a chapter covering an immense range of applications; and (6) a bibliography with classified index containing about 1100 references.

The book deserves the highest praise throughout for clearness, trustworthiness, comprehensiveness, and interesting style. One might perhaps have wished to see the applications treated in greater detail, but when the number of references is realised readers will perhaps be inclined to agree with the author that it may be better to leave the detailed treatment of applications to the several sciences to which they belong. The author divides applications into two classes: (*a*) Those in which the phenomenon under investigation or control is seriously affected by the p_H of the solution and which require the most accurate methods available. For these he recommends the use of the electrometric method. Obviously the difficulties to be met and corrections to be made increase greatly with the accuracy required, and it would have been interesting to hear to what degree differentiation of potential has been hitherto usefully applied. (*b*) For those applications in which so high a degree of accuracy is not required the author recommends the indicator methods. The reviewer is inclined to believe that when the millivoltmeter system of measurement is employed (which in the present book, as in most American publications, is ascribed to Hildebrand, but which was fully described two years before Hildebrand by the reviewer, in conjunction with Wood and Law, in its application to tan-liquors), the electrometric method has many advantages over the indicator method in cases where the total curve of neutralisation by acids and alkalis is important, and in which an accuracy of about one centivolt is sufficient. Thus, in the examination of soils one titration of the soil suspension with an acid and one with an alkali by the electrometric method will show not only the hydrion concentration of an extract of the given soil, but also the hydrion concentration which such an extract would show after known quantities of acid or alkali have been added to or have been formed in the soil.

The reviewer feels confident that, in spite of the large amount of work already done, there still remains a widening field of application for the determination of hydrion concentrations; and also that the present book will contribute materially to the popularisation and extension of this important branch of physico-chemical measurement and inquiry. HENRY J. S. SAND.

THE PRINCIPLES OF THE PHASE THEORY. *By* DOUGLAS A. CLIBBENS. *Pp.* xx.+383. (*London: Macmillan and Co., Ltd.* 1920.) *Price* 25*s. net.*

There is in many quarters to-day an increasingly clear perception, based to some extent on war experience, of the definite bearing of physical chemistry on many technological problems, and the present volume may be regarded as a product of this view. The particular field with which Dr. Clibbens deals has been cultivated more especially by the Dutch school of physical chemists—Roozeboom, Schreinemakers, and others—and has received all too little attention in Britain. On this ground, as well as on its own merits, the appearance of an authoritative work dealing with the phase rule in the English language is to be heartily welcomed.

The principles of the phase theory make possible a rational survey of the influence of temperature and concentration on the equilibrium condition of a material system, and it is in the resulting unification of treatment that the value of the phase rule mainly consists. A remarkable feature of the development of this subject has been the graphical methods, such as the equilateral-triangle representation and the projections of the space diagrams, devised to facilitate the recording of the complex phenomena involved. In this connexion there is an interesting remark made by Mr. F. A. Freeth, who contributes an introduction and to whom the volume largely owes its inception, viz., that the graphical methods introduced for phase rule purposes have served to emphasise the vital principle that *every point* on a diagram—not merely those on the curves—has a definite meaning.

Within the limits which Dr. Clibbens has set himself the present volume furnishes a detailed and thorough treatment of the subject, compiled by one who is evidently at home in these matters. The argument is on non-mathematical lines, and the development can be followed by a beginner, but at the same time he must be prepared for much patient work if he aims at achieving a real mastery of the subject. The power to interpret a complex phase-rule diagram is not easily acquired, and, in view of the concentrated attention which even a few pages of the present volume demand, it is scarcely suitable for the undergraduate student as an introduction to the phase rule. For the advanced or research student the book can be heartily recommended, and it is matter for congratulation that such a volume is now available for English readers.

The author purposely limits the scope of the work to the consideration of condensed systems, including only one liquid phase, and that the only phase of variable composition. His view, with which most physical chemists will agree, is that a true comprehension of the phase theory can best be attained by a thorough study of the condensed system. Further, it should be noted that the experimental illustrations of the theory which Dr. Clibbens discusses are taken solely from the field of salts and aqueous solutions, although naturally the theory developed is equally applicable to all condensed systems.

Somewhat less than half the book is devoted to the consideration of condensed binary and ternary systems, while the remainder is concerned mostly with quaternary and quinary systems. Naturally, the graphical representation plays an all-important *rôle*, and the volume is profusely illustrated with some two hundred diagrams. As regards the text, the reviewer has the feeling that there is occasionally too much repetition. On the other hand, mastery of the principles and methods of the phase rule can admittedly be achieved only by the most painstaking attention to details, and a little over-repetition is not a serious fault in this case.

James C. Philip.

The Carbohydrates and Alcohol. *By* Samuel Rideal *and Associates. Pp.* 219. *Industrial Chemistry Series. (London: Ballière, Tindall and Cox.* 1920.) *Price* 12*s.* 6*d. net.*

This volume is one of a series designed to give a comprehensive survey of the chemical industries. The series, of which nine or ten volumes have already been published, has been conceived on somewhat novel lines, one of the aims being to present to the advanced student the reality of the living industry without confusing his mind with details and figures, which may be obtained from more highly specialised text-books. In certain respects this aim is admirably achieved in the present volume, and the sections on cane and beet sugars, which occupy roughly 100 pages, or about half of the book, give a clear, succinct, and eminently readable account of the commercial production of sucrose. A short history of the development of sugar production from the earliest times, and an outline of the physiology of the sugar cane and of the agricultural methods adopted, add greatly to the value of these sections.

Of the rest of the volume the impression gained is that an attempt has been made to cover too much ground. The subject of patent stills is dealt with in 25 lines, and the use of alcohol as a fuel in 20 lines. Beer and brewing occupy 20 pages, and only nine are allotted to wine, including the recovery of tartar. Thirty pages are devoted to grain spirit, potable spirits, industrial alcohol and synthetic alcohol.

Within these limits the subject matter is well and clearly dealt with, and the authors have contrived to get a large amount of information into a small compass, but the value of the book would have been greatly enhanced by a fuller treatment of fermentation and distillation. The authors have no doubt been restricted by limitations of space, but it would perhaps have been more satisfactory if the fermentation industries had been dealt with in a separate volume. It might then have been possible to include a few more diagrams and illustrations of plant, which in the sections on fermentation are conspicuous by their absence.

The production of alcohol by the hydrolysis of wood and subsequent fermentation of the sugars formed is included in the section on synthetic alcohol. This arrangement seems to call for revision, as the term "synthetic" can strictly be applied only to alcohol produced from acetylene or ethylene, or by methods other than fermentation.

The book contains so many excellent features and is written in such a clear and attractive style that it is to be hoped that in future editions the treatment of the subject matter will be more evenly balanced, even if this involves considerable expansion.

G. W. Monier-Williams.

First Report on Colloid Chemistry.—By arrangement with the Department of Scientific and Industrial Research, the First Report of the British Association on Colloid Chemistry and its Industrial Applications is to be reprinted and issued for sale by H.M. Stationery Office. Copies (price 2s. 6d., or by post 2s. 7½d.) may be obtained through any bookseller, or from H.M. Stationery Office in London or its branches in Manchester, Cardiff, and Edinburgh. A small stock is also held for sale at Messrs. Hortons, Harrison Street, Johannesburg, South Africa, and by the Government Printer, Wellington, New Zealand. The Report is no longer to be obtained from the offices of the British Association.

PUBLICATIONS RECEIVED.

Factory Administration and Cost Accounts. *By* E. T. Elbourne. *New edition. Pp.* 811. *(Longmans, Green and Co.,* 1921.) *Price* 45*s.*

The Testing of Dyestuffs in the Laboratory. *By* C. M. Whittaker. *Pp.* 100. *(London: Heywood and Co., Ltd.* 1921.) *Price* 12*s.* 6*d.*

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THE DRAFT HOME OFFICE REGULATIONS FOR CHEMICAL WORKS.

(From the Association of British Chemical Manufacturers.)

The provision of hygienic conditions for labour and of protection from danger for workers is now recognised as being absolutely essential in every industry, and especially is this so in the chemical industry where the work involved in certain manufactures is of a dangerous and unhealthy character. The draft Regulations for Chemical Works recently issued by the Home Office have set a very high standard for the conditions of employment to be maintained in chemical factories. This is very desirable, but it is felt by a large section of the industry that some of the proposed demands are of an extravagant and impracticable nature. In the larger and more modern works the provisions made for the health and general welfare of the employees are in most cases excellent, but the enforcement of the proposed regulations will, even in these instances, involve additional expenditure. It is therefore to be regretted that the new regulations are being introduced at a time when the financial position of the industry cannot bear the additional expense which will be incurred in carrying them out. This is particularly true of the smaller chemical works engaged in branches of the industry which are at present in their infancy, such as fine chemicals, intermediates and dyes, and it is generally recognised that at the present time it is not in the interests of the industry at large to place upon those works additional burdens unless they are absolutely essential to the welfare of the worker.

Part I of the Regulations applies to all chemical works and includes provisions for mess and washing accommodation, ambulance and rescue equipment. These provisions would doubtless conduce to the well-being of the worker, but they are framed on too lavish a scale. The demands made for the provision and maintenance of suitable protective clothing (Clauses 11 and 12) are of an extravagant nature unless they are restricted in their application to those persons *constantly* engaged in work involving *continuous* exposure to wet or dust or to substances of a corrosive or poisonous character. With regard to the supply of adequate bath accommodation (Clause 15), the employer has received very little encouragement in this respect in the past owing to the small advantage taken by the worker of the bathing facilities placed at his disposal. It is therefore only natural that the smaller manufacturer should feel reluctant to expend money on the installation of baths when it is probable that little use will be made of them by the employee. As regards Clause 21, which provides sitting accommodation for employees " whose work is done standing," it is generally agreed that such a provision is impracticable and open to abuse. It is further considered that greater detail is required in the wording of the regulations in order to enable them to be carried out effectively. In the provision relating to the use of life-belts and rescue apparatus, for example, it is essential that the size of the manhole should be specified, and it is considered that the provision of an efficient exhaust-draught in lime-slaking (Clause 3 (b)) should only hold good when the quantity of material used in the process exceeds a specified limit. Clause 2, which refers to the provision of adequate measures to prevent steam from obscuring platforms, passages, etc., is obviously impracticable, unless it applies only when the surroundings are *continuously* obscured by the evolution of steam.

In Part II of the Regulations the provisions apply particularly to those works in which caustic pots are used and to places where chlorate, bleaching powder, dyes, and intermediates are manufactured. In these cases the regulations relating to washing facilities are naturally more stringent and involve the supply of baths, nail brushes, soap, clean towels, the provision of which, although desirable, is so readily abused in practice. It is, of course, generally recognised that all these precautions are absolutely essential in the manufacture of such irritants as dinitrochlorobenzene and TNT, and it is doubtless the experience gained in this respect during the war which has led to the inclusion of these provisions in the new regulations. It is to be feared, however, that according to the schedule of processes included under Part II, it will be necessary to satisfy these provisions in many cases where they are not absolutely necessary. The provision for the repair and cleaning of gloves (Clause 31 (a)) is regarded as impracticable, and it is considered that the washing facilities provided for in Clause 33 should be supplied only for those workers who are *continuously* engaged in the various processes mentioned.

It is generally felt in the industry that had the collaboration of such a body as the Association of British Chemical Manufacturers been secured in the compilation of the regulations they would have been found more generally acceptable to all sections of the industry.

THE BRITISH GAS MANTLE INDUSTRY.

Among the industries that are seeking State assistance through the projected Government Bill relating to " key " industries are the gas-mantle and subsidiary industries. On behalf of these a statement has been presented to the Board of Trade by the Incandescent Mantle Manufacturers' Association, the main points of which are summarised below:—

The Gas Mantle Industry bases its claim to be regarded as a " key " industry upon the following considerations:—I. Both in time of peace and in time of war incandescent gas lighting is necessary for the adequate illumination of docks, railways, factories, etc. II. It is estimated that 32 million tons more coal would be required yearly to produce the same illumination if flat-flame burners were used instead of gas mantles. III. The " stripping " of coal gas has been found necessary to ensure adequate supplies of benzol, toluol, and other hydrocarbons for the manufacture of dyes, drugs, and explosives; such " stripped " gas can only be used as an illuminant in conjunction with the gas mantle.

The value of the industry from the standpoints of efficient illumination and coal conservation was recognised by Lord Balfour of Burleigh's Committee on Commercial and Industrial Policy, and recent legislation authorising the sale of gas on a calorific, instead of an illuminating, basis has further emphasised the importance of the gas mantle. In Germany the essential nature of this industry, including the raw materials therefor, has been recognised by granting special allocations of coal at the lowest price and supplies of gas which are otherwise restricted.

Before the war the rare-earth chemicals and the gas-mantle industry were mainly under foreign domination. The total output of Indian monazite sand went to Germany, and British mantle-makers had to purchase thorium nitrate abroad at a price fixed by the Thorium Convention, a combine of German and Austrian manufacturers which was itself controlled by the chief German maker of gas mantles. Further, foreign mantles were sold in this country at prices 2—35 per cent. below English factory costs, and 23—70 per cent. below the selling prices in the countries of origin. In 1913 foreign importations amounted to between 45 and 50 million finished mantles and over 11 million partly finished (about 70 per cent. of our entire consumption), and the latter were marketed in such a way as to evade the payment of British income tax by the English branch of the German combine, the Auer Gesellschaft. In the same year the English production was 22 million mantles, of which 10 million was made by a company associated with the German combine.

In consequence of this foreign domination the home industry became very precarious; nearly all the factories were running at a loss, wages were low, and employment uncertain and unsatisfactory. Hence at the outbreak of war there was insufficient plant to meet the country's requirements, supplies of thorium nitrate were cut off, and there was a shortage of clay rings and other materials required by the industry. To overcome these difficulties the Indian monazite deposits were placed under British control, and five home manufacturers took up the preparation of thorium nitrate, although until the factories were ready the nitrate had to be purchased abroad at arbitrary prices which showed large profits to foreign suppliers. These factories can now produce all the gas mantles the country requires; and during the war they supplied the cerium fluoride and cerium oxalate needed for searchlights and tracer bullets. Prior to the war all the mantle rings required by the home industry were either imported from Germany or supplied by a German-owned company with branch works in this country. These works were purchased by a group of the chief British mantle-makers and so extended that they are now able to meet the country's requirements, although not yet in a position to produce the full range of designs which were offered by the Germans. Ramie yarn, which was also derived from Germany before the war, can now be supplied by British spinning plants in sufficient quantity to meet all requirements.

Owing to the extensions made to buildings and plant (at war prices), and to the establishment of three or four new factories, the output capacity of the home industry is now over 130 million mantles per annum, which is sufficient to leave a considerable surplus for exportation. The following data show the position of the British industry in 1913 and on October 30, 1920:—

	1913.	1919-20.
Output of mantles	32,000,000	82,322,000
Capital employed..	£440,670	£1,525,710[*]
Workers employed	1843	3783

[*] Exclusive of £350,000 invested in the thorium nitrate and other subsidiary industries.

The present annual consumption of gas mantles is valued at £1,750,000; £400,000 is paid in direct wages, and at least an equal sum as indirect wages to convert the imported raw materials into the products used by the industry, labour and wages entering into the cost of the finished article to a degree unusual in other industries. The raw materials used by the gas-mantle manufacturer include thorium nitrate and other chemicals, cotton, ramie, artificial silk, asbestos yarns, clay rings, and cardboard boxes. At the present time there is grave stagnation in the above trades, which is mainly due to the increasing importation of foreign mantles (over 10 million in 1920), and the prospect of further competition at prices below British manufacturing costs. The low prices of foreign mantles are the result of :—(a) Attempts by foreign makers to recapture their former markets at any cost; (b) the low rate of foreign exchanges; (c) longer working hours in foreign factories (60 hours or more per week compared with 48 in this country) and the lower standard of living of the worker; (d) large pre-war stocks of certain raw materials held by German manufacturers. The British consumer is not obtaining the full benefit of the lower prices, as the intermediate profit is mainly retained by the importers and dealers. The Labour representatives on the Joint Industrial Council for the industry proposed a resolution, which was passed unanimously, deploring the increasing importation of foreign mantles, and urging the Government to take steps to counteract the effects due to foreign rates of exchange. At the present time some of the British factories are closed down, and the rest are working short time; manufacturers are carrying large stocks at a season when demand normally exceeds the rate of production; employment in the industry is declining, and generally the situation is so serious that immediate action is imperative. In conclusion, it is submitted that the manufacture of thorium and rare-earth salts, incandescent mantles, and clay rings be recognised and assisted as "key" industries; that legislation be introduced forthwith to protect the British worker against unemployment resulting from foreign competition; and that the British manufacturers who have responded to appeals to lay the foundations of a self-supporting industry be assured a market free from unfair competition.

THEORY AND PRACTICE IN CHEMICAL INDUSTRY.

With special reference to Physical Chemistry.[*]

E. B. R. PRIDEAUX.

Although the principal difficulties under which chemical industry is labouring in this country are political and social, and therefore beyond the control of industrial organisers and chemists, there is a minor handicap, the neglect of theory, which can be overcome by the efforts of individual workers. The most successful practical men are, unconsciously, often great theorisers, but in most cases they would increase their efficiency by studying the theories which bear upon their processes—if only to distinguish between practicable and impracticable inventions, between theories which lead nowhere and others which embody useful working hypotheses. In building up a healthy industry able to withstand severe foreign competition, theory and applications must be closely allied. For new points of view and working hypotheses, the industry is dependent, as it always has been, upon the work of private investigators, and especially upon the research work done in universities and technical colleges. In his presidential address to this Society in 1904, Sir W. Ramsay related how a scientific friend once pointed out to him that most of the changes which had been introduced in industries had originated in universities. Why? Because the investigator is unfettered. If a man sets out to improve an existing process he will very likely succeed, but he will not revolutionise a manufacture.

Not the least useful part of the expenditure of the Department of Scientific and Industrial Research has been that applied to maintenance grants in aid of student research workers in pure science. The business community would do well to follow the splendid example of private munificence which has been set in Nottingham and provide donations, to be used more especially for increase of staff and equipment, in order to give the research students of Nottingham the best possible chances of distinguishing themselves, and of becoming versed in, and putting to the test, a wide range of theories. Both in applied and in pure science theories are the "imponderables" which enable us to control ponderable phenomena.

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[*] Paper read before the Nottingham Section on Dec. 15, 1920.

Few will doubt the efficacy and value of the "common stock" chemistry, in which the essential has been so thoroughly sifted from the unessential, and the ways made so plain that a good grasp sufficient for application can be obtained in a three years' course. Much of this was, however, in its inception "physical chemistry," and most strange to the orthodox chemists of the early 19th century. Now a new science, or rather many branches commonly summed up as "physical chemistry," have grown on the "common stock," and the student, sometimes also the teacher, stands bewildered. How much of all this is to be mastered, how much left untouched? It seems probable that in these branches the great advances of the future will lie, as they are applied one after another to the hitherto unsolved, or only empirically solved, problems. It is in these uncharted regions that gold is to be picked up, not necessarily for private profit, but for the advantage of the whole nation and humanity; and the more uncharted the country, the more necessary is the guidance of theories, even if these are only provisional in character and if each leads only a short part of the way.

Hence any real success in applied science is only gained after a liberal training on the theoretical side. The successful inventor or improver in chemical industry must be able to assimilate the results of research in pure science, and he must be quick to see their bearings and able to work out their applications. The trouble is that it is difficult or impossible to discern the bearing of a theory on technical processes until it has been read and understood. The original papers are perhaps written in difficult language, an interpreter is required, and he is usually a teacher who introduces it into a text-book. But long before this the first fruits may have been seized by some industrial chemists who have been adequately trained to master and apply theories.

The tendency in works' laboratories is to tabulate the results of pure science and to work out their applications, and the newly-formed Research Associations are in many cases working along these lines.

This is perhaps a partial answer to the question asked by many entrants into the chemical profession: Of what use is physical chemistry to me, or what opportunity shall I have of practising principles which will perhaps require an inordinate amount of time and energy? If the young man of good will and energy will enter these studies, he will surely find in them sufficient interest to carry him on, and eventually they will afford him a greater choice of posts in the profession. Although he may consider himself rushed during his university career, actually he has then more time and available energy than afterwards when he is in full work. Many of the most useful branches of physical chemistry can be applied quite effectively to a first approximation with the aid of sound elementary mathematics. Indeed, it is not so much the mathematics involved as the abstract ideas which present the difficulty. For example, those of osmotic pressure, concentration action, solubility product, electrolytic solution pressure, ions, free and total energy, the EMF of chemical reactions, velocity constants, and thermochemistry all require careful consideration from several points of view before they can be assimilated. Some can grasp them at once in the abstract form, but the usual road to, and test of, comprehension is through the working of numerical examples. By whatever means, the essential principles ought certainly to be acquired in student days as so many foundations upon which complete buildings may later be erected.

It will be found that thus an added power and a deeper insight into technical problems are obtained. Even when processes have reached a high degree of perfection and are run according to rule, so that apparently they hardly need the supervision of a professional chemist, it will be safer to employ one who has gained this depth of insight. However stereotyped a process may become, it has to be grasped by each new generation, and a study of the theories is the surest method. Even long-established processes occasionally break down, and few chemical reactions are as perfectly controlled as a steam engine.

The great generalisations of physical chemistry are required for the solution of most problems as soon as the reactions are carried out on a large scale. For example, the behaviour with regard to changes of pressure, temperature, and concentration of systems consisting of a gas, one or two liquids, one or more solids is described and put on a quantitative basis by the phase rule and other deductions from thermodynamics. There are some works chemists who consider the phase rule as important a tool as the "slide rule." These theories, with the aid of applied physics, dominate the operations of distillation, crystallisation, extraction and filtration, just as applied physics dominates those of heat exchange, flow of fluids, grinding and mixing; and the mere chemical side of physical chemistry dominates those operations in which chemical equilibrium, velocity of reaction, and electro-chemical processes are most important. To take one example, the laws relating to the crystallisation of mixed liquids are of the first importance in ferrous and non-ferrous metallurgy. A study of the conditions of formation of eutectics, of maximum freezing-point, compounds and solid solutions of various types, are equally important in organic chemistry. Thus, in the manufacture of margarine the freezing-point diagrams of the fats stearin, palm oil, etc. have been studied in order to obtain a mixture of from three to six fats which melts at about 25° C.

In the examination of technical products physico-chemical or physical tests have largely replaced chemical analysis. Thus, in ferrous metallurgy cooling curves, heat treatment, and microscopic analysis give the most important information. In other branches of industrial analysis it is often a question of determining the amounts of two or more *known* constituents of a mixture. Two physical constants, such as the density and initial boiling-point, may be sufficient to characterise the mixture. Numerous examples may be found of these methods in recent issues of the *Journal*. Sometimes a single constant such as the optical rotation is sufficient. The use of the refractometer, for example, is becoming very prominent. A single drop of liquid suffices to give a number which distinguishes oils from one another or which reveals presence of admixtures. A useful example of the combined use of refractive index and other constants in butter analysis is to be found in the work of Mr. H. D. Richmond, who also informed the author that the refractometer is largely used in the jam industry to determine the degree of evaporation of the syrup.

To illustrate the manifold applications of physical chemistry it is not necessary to go beyond the record of this Section. Reference need only be made to the work of Sand, Wood and Law, who have adapted the hydrogen electrode to determine the acidity of dark-coloured tan liquors; to that of Procter, who has investigated the effect of acids and alkalis upon gelatin and leather material from the physico-chemical point of view; to that of Archbutt on the skin effect in lubricants; and to that of Wilkie on the conditions of reduction of arsenic compounds at a lead kathode, which are doubtless capable of interpretation in terms of reduction potentials and velocities of successive reactions. The author believes that the industries of the East Midlands are waiting for control chemists able to interpret the wealth of research which has long been available. Can anyone suppose that the last word has been said in the exploitation of gypsum deposits? or that the chemical utilisation of our splendid coal deposits is carried on as largely as it might be in the district? or that great economies in labour and material, as well as improvements in the products, are not possible in our textile industries so soon as these are fully staffed with chemists?

One of the best examples of the value of working hypotheses is afforded by colloid chemistry. The chemical formulæ of soaps are well established, reversible chemical equilibria are present, and a regular gradation is found through acids and salts, such as acetates and propionates, which behave as regular electrolytes, up to oleates which exhibit truly colloidal phenomena. The properties of soap solutions cannot be interpreted in terms of the ions of sodium and of free acid radicle, more or less hydrolysed, giving free alkali and uncombined acid, which is more or less in the colloidal state. The question has now been attacked by the methods of conductivity, osmotic pressure, viscosity, surface tension, microscopy, ultramicroscopy, and ultrafiltration. The results as summarised in the Reports on Colloid Chemistry are of outstanding importance to all makers and users of soap. The work of the founders of colloid chemistry, as well as that done on soap by Harkins, Hillyer, Spring, Pickering, Donnan, McBain, and many others, has now resulted in descriptive theories which will enable anyone trained in the principles to take up technical problems with a fair chance of success. Immediate practical results are numerous, such as the recommendation to use sodium oleate in cold solutions on account of its solubility, and sodium stearate in hot solutions on account of the persistence of its colloidal nature. In order to account for the relatively high electrical conductivity, relatively low alkalinity (low hydrolysis), McBain has postulated the existence of "ionic micelles"—aggregates of fatty acid ions highly charged as compared with usual colloidal matter, and not visible by the ultramicroscope. These particles functioning as protective colloids account for two of the principal uses to which soaps are put. As a small quantity of gelatin or other colloid prevents the coagulation of red gold sols by salts, so the soap colloid prevents the coagulation of dirt particles, or rather assists their passage into the dispersed state in which they are easily washed away.

The production of stable aqueous emulsions by the addition of small quantities of soap is explained in a similar way, but is still more precisely described by Donnan and his co-workers as due to the lowering of the tension at an oil-water interface by the addition of small quantities of soap. Here the entirely theoretical work of Willard Gibbs pointed out the way which has led to such eminently practical results.

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In connexion with the above paper, Mr. H. Droop Richmond communicated the following:—Dairying is one of the oldest industries; it is not usually regarded as a chemical industry, nor as affording much scope for the application of physical chemistry, but when it is considered that the raw material—milk—is an emulsion of fat, in the liquid or solid state, in an amphoteric colloidal solution of the soluble salts of a complex, fairly strong insoluble acid, no further argument is required to show that physico-chemical problems of the highest order occur in dairying. As an old industry, it is apparent that very many of the problems have been worked out by empirical methods, but they are far from having been elucidated completely. We do not know for certain the state of the fat globules in milk, though I think that my work, undertaken in conjunction with my brother, has shown that they are liquid above the melting-point of fat, and solidify very slowly on cooling; and I think that there is little doubt that they are not surrounded by any membrane other than a colloidal layer condensed by surface energy. We have comparatively little information as to the variation of this layer with changes of temperature, especially when the temperature is raised to such a degree that irreversible changes take place in the serum, yet this fact has importance in dairying. The laws of the rate of motion of these globules when submitted to the force of gravity, centrifugal force, and irregular impulses are only partially known, though of the highest importance in cream separation and butter churning. The motion of single globules is comparatively simple, but in milk the globules vary greatly in size and the practical importance of the laws of their motion becomes greater as their complexity increases, owing to close packing and also to variations of temperature; and until their laws are fully elucidated the scientific design of separators and churns is impossible.

The amphoteric nature of milk is due to the presence of salts of polybasic acids, the hydrions of which have widely differing concentrations; that is to say, hydrion concentration in milk does not vary with acidity. Cheese-making, which depends primarily on enzymic action, which in its turn is influenced by the hydrion concentration, has been controlled largely by acidity determinations in the main satisfactorily, but there is no doubt that a more scientific application of physical chemistry would result in an important improvement. In the manufacture of condensed milk, the hydrion concentration is increased and, unless the proportion of buffer salts is increased, it becomes too great to enable the milk to withstand the subsequent operation of sterilisation without the separation of insoluble acid salts; and this raises an interesting physico-chemical problem. The problem of escape of dissolved gases from a colloidal solution, attended by great foaming, has considerable importance. In the manufacture of casein and milk sugar there is on the one hand the problem of the separation and drying of a colloidal precipitate, and on the other the crystallisation of the sugar from a solution containing crystallisable salts.

CULTIVATION OF THE AFRICAN OIL PALM.

With special reference to the East Indies.

An interesting article has appeared under the above title in the *Bulletin of the Imperial Institute* (1920, 18, No. 2, 209—252). Hitherto nearly all the palm oil and palm kernels of commerce has been obtained from wild trees in West Africa. The palm oil is prepared by the natives mainly by primitive methods which frequently result in the production of a low grade of oil, and the kernels are usually extracted by cracking the nuts by hand, thus entailing a great waste of labour. Owing to the great demand for fats of all kinds at the present time, much attention has recently been devoted to the cultivation of the palm in plantations and the preparation of the palm oil and kernels under modern factory conditions. The article under review has therefore been written with the primary object of supplying information which will be of service to planters or companies who may contemplate the establishment of oil-palm plantations. It deals fully with the distribution of the oil palm and the present position of its cultivation in various countries, describes the palm and its chief varieties, the climatic and soil conditions best suited to its growth, and the methods of cultivation and harvesting. The question of yields is discussed, and estimates are given of the probable financial returns obtainable from a plantation. The following points may be mentioned as of especial interest.

The importance of the oil-palm industry in West Africa may be gauged by the fact that the total annual exports now amount to about 130,000 tons of palm oil and 400,000 tons of palm kernels. The greatest output is in Nigeria, and in 1919 more than 100,000 tons of palm oil and 216,913 tons of kernels were exported from that country. Palm-kernel oil is not produced for export in any part of West Africa except Nigeria, whence 3356 tons was shipped in 1919.

Comparatively little attention has been given hitherto to the cultivation of the oil palm in plantations in West Africa, but plantations have been made in the Cameroons and at Gazi in the Belgian Congo, whilst in San Thomé the palm is commonly planted as shade for cocoa. The production from the wild trees could be greatly increased by thinning out the trees and clearing the undergrowth round them.

The cultivation of the palm as a regular plantation industry has only been carried on up to the present on the east coast of Sumatra, where in 1919 the area devoted to this crop amounted to 12,800 acres, of which 6900 acres was in bearing. The palm has been planted successfully on a smaller scale in the Malay Peninsula, and several large areas have recently been taken up in the Federated Malay States for its cultivation on a commercial scale. In Sumatra the trees usually begin to fruit at the end of the fifth year, but in some cases they bear a crop in the fourth year.

Little is known with regard to the yield of fruits from the different varieties of oil palm, and therefore it is not easy to recommend any particular variety for cultivation. Assuming that the yield is satisfactory, however, it is desirable that a thin-shelled variety should be selected which gives a high yield of oil from the pulp and a fair yield of kernels. If the nuts are to be shelled by hand, the thickness of the shell is very important, but is of less consequence if nut-cracking machinery is employed.

The oil palms on the east coast of Sumatra are regarded as probably all derived from one variety, but it is not yet decided with which African variety this kind is identical. The advantage of cultivation is shown by the fact that in Sumatra, as also in Malaya, the tree has proved remarkably precocious, yielding large quantities of fruit at a much earlier age than in West Africa.

Detailed information on the yields given by trees of various ages in the Sumatra plantations has been given by Dr. A. A. L. Rutgers in *Mededeeling van der Algemeene Vereeniging van Rubberplanters ter Oostkust van Sumatra* (Algemeen Serie, No. 6, 1919, and No. 8, 1920), and the tabular statements therein have been reproduced in a somewhat modified form in the article under review. These tables give statistics of the gross yield of bunches and of fruits, the percentage of pulp, nuts and kernels in the fruits, and the percentage oil content of the pulp and kernels. From these particulars the following conclusions have been drawn.

The estimated normal annual yield of a plantation in lb. per tree is given below for trees of different ages:—

—	Number of bunches.	Weight per bunch.	Total weight of bunches.	Total weight of fruits.
5th to 10th year ..	12	13.2	158	53
11th to 30th year ..	10	33	330	165
31st to 50th year ..	3	44	132	66

The oil palms now generally grown on the east coast of Sumatra give a high yield of pulp (62 per cent. of the weight of the fruit) and a low yield of kernels (8 per cent.). The fresh pulp of the fruits contains about 55 per cent. of oil and the kernels contain about 50 per cent. These yields are regarded as very satisfactory.

In establishing an oil-palm planting industry on modern lines—that is, with the use of machinery for preparing the palm oil and cracking the nuts—it is estimated that it would be necessary for profitable working to plant an area sufficient to produce 6000 tons of fruit per annum. From the fifth to the tenth year the average annual yield of fruits per tree is 53 lb., and from an acre bearing 64 trees (*i.e.*, planted 26 ft. × 26 ft.) the total yield would thus be about 1½ tons; the actual area required to produce 6000 tons of fruit would therefore be about 4000 acres.

The theoretical yields of fruits and oil from an acre of oil palms planted with 64 trees are given as follows:—

	Number of bunches.	Total weight of bunches. Tons.	Total weight of fruits. Tons.	Total weight of pulp. Tons.	Total palm oil. Tons.	Total weight of kernels. Tons.	Total palm kernel oil. Tons.
5th to 10th year	768	4·51	1·51	0·906	0·498	0.121	0·060
11th to 30th year	640	9·44	4·72	2.826	1·554	0·377	0·189
31st to 50th year	192	3·77	1·89	1·134	0·624	0·151	0·075

In calculating the profits obtainable from an oil-palm plantation, it is necessary to take into consideration not the theoretical yields quoted above, but the practical yields. With modern machinery it should be possible to extract 80 per cent. of the oil contained in the pulp, and the whole of that in the kernels. The practical yield, therefore, may be estimated as follows:—

	Palm Oil.		Palm Kernels.	
	Per acre. Tons.	Per 5000 acres. Tons.	Per acre. Tons.	Per 5000 acres. Tons.
5th to 10th year ..	0·398	1990	0·121	600
11th to 30th year ..	1·243	6220	0·377	1880
31st to 50th year ..	0·499	2500	0·151	750

On the basis of these results, together with considerations of the cost of machinery, land, labour, and upkeep, and the market value of the produce, it is shown that oil-palm plantations are likely to prove more profitable than coconut estates.

SOCIETY OF CHEMICAL INDUSTRY.

NEWS FROM THE SECTIONS.

GLASGOW.

At an informal meeting held on January 12, with Mr. J. H. Young in the chair, short papers were read on "Gas Warfare" by Prof. F. J. Wilson, and on "The Use of Magnesium Oxychloride Cements in Ships" by Dr. J. G. Robinson. The first paper described the methods of gas warfare used by the enemy, the nature of the substances employed and their physiological action. Dr. Robinson outlined the development of the manufacture of magnesium oxychloride cements, described their use for ornamentation and mural decoration, and concluded with an account of the application of composition flooring as a substitute for wood decking on board ship. When used in conjunction with hard-wood sawdust, these cements make an ideal decking, as they are very resistant to heavy wear and tear, are fire- and vermin-proof, and are better insulators than wood. They can be laid more thinly and more quickly, and are cheaper than wooden decks. The danger of corrosion and the means of preventing it were described, and the difficulties were shown to be due mainly to the presence of excess of water, which vitally affects the expansion and also the tensile strength.

EDINBURGH AND EAST OF SCOTLAND.

An informal meeting was held in the Hall of the Pharmaceutical Society, Edinburgh, on January 18, Mr. J. Rutherford Hill presiding. Prof. G. Barger presented a communication on the Micro-Dumas Method of Determining Nitrogen, the apparatus being demonstrated by Mr. Harington. Mr. B. D. W. Luff showed a device to avoid overstepping the end-point of a titration, and Mr. M. T. Hay described a safety device for Carius tubes. Mr. W. T. H. Williamson gave a short account of the present position of the theory of soil acidity, and described some recent methods of testing acid soils.

NEWCASTLE.

At a meeting held in the Chemical Lecture Theatre of Armstrong College on January 26, a demonstration was given of the froth flotation process for the washing of coal. Mr. A. Bury, of Skinningrove, read the introductory paper and Mr. Bicknell carried out the subsequent demonstration.

Mr. Bury briefly reviewed the development of the coal-washing industry and pointed out that all methods previously used had depended upon the difference in specific gravity between the coal and the associated waste. Such methods failed in treating fine material, and the need had long been felt for a complementary or supplementary method capable of dealing with these refractory fines. A successful method had been devised by the Minerals Separation, Ltd., which was now being worked in Wales on a commercial scale.

A special laboratory has been established at Skinningrove with machinery and apparatus capable of dealing with samples from 400 gm. up to 1 cwt., which is at the disposal of all interested in the subject in the Cleveland, Durham and Northumberland districts. During a year's work at this laboratory many coals have been tested and the process has proved of the widest applicability. A list of excellent results obtained on raw coal, washery refuse, pit refuse, dump material, picking waste, etc., was given. Most coals consist of a mixture of pure coal of low inherent ash, bone coal containing high inherent ash, and shale containing varying amounts of bituminous matter. It is possible by the proper application of the flotation process to separate these constituents one from the other and thus obtain :—(*a*) A clean product of low ash content which gives an excellent coke, (*b*) a bony coal to be used for fuel purposes, and (*c*) a shale free from coal.

In making the demonstration it was shown that when water is agitated with small quantities of certain reagents, numerous very fine air bubbles are formed. When the coal is added to such a mixture the air bubbles attach themselves to the coal particles, and when the pulp is brought to rest the bubbles rise to the surface carrying the coal particles with them, forming a froth in which the solid particles are supported; the shale particles remain suspended in the water or settle at the bottom of the containing vessel. Mr. Bicknell demonstrated the efficiency and simplicity of the process, obtaining both clean coal and clean shale residues.

LIVERPOOL.

On January 24, a meeting of this Section was held at Midland Adelphi Hotel, Liverpool. Dr. E. F. Armstrong presided, and Dr. Stephen Miall read a paper on "Diseases of Occupation."

Dr. Miall stated that, broadly speaking, constant exposure to any chemical compound was likely to be injurious to health, particularly when the compound gave rise to dust, fumes, or gas. The best general preventive was undoubtedly an abundant supply of fresh air, and the old-fashioned, dilapidated works had compensatory advantages over modern factories inasmuch as broken windows let in air and the worker was given a variety of occupations. Poisoning by gases from gas and internal combustion engines was increasing, but in nearly all cases was due to ignorance or carelessness on the part of the worker. After describing some measures which had led to the practical extinction of phosphorus poisoning, Dr. Miall referred to the toxicity of turpentine as the cause of the poisonous effects due to inhaling fresh paint, and then dealt with the characteristics of metallic poisoning, notably by lead and lead compounds. The diminution of cases in the white lead industry was very remarkable, and was the outcome of 20 or 25 years' study and the steps taken by the Home Office. The prohibition of the use of lead in paints would not adequately solve the problem; the real remedy was fresh air. Painters should rub down old paint with sandpaper moistened with mineral oil. Lead pigments should always be supplied ground in oil or other medium, and adequate ventilation would do the rest. It was difficult to induce such organisations as the International Labour Office to regard the subject of occupational diseases from the modern medical standpoint, so obsessed was the public mind with the bad conditions which prevailed some twenty-five years ago, but which had since been remedied. The International Labour Office may do much good, but it will accomplish nothing in the sphere of industrial hygiene without the co-operation of those primarily affected.

BRISTOL AND SOUTH WALES.

A meeting of this Section was held on February 3, at Bristol. Mr. E. Walls presided, and Mr. D. T. H. Beaton read a paper on "The Brewing Industry," in which he traced the development of the art of brewing from the earliest times to the present day. It was stated that the origination of the art was ascribed to Isis in 1960 B.C., and that Herodotus had mentioned the production of beer from barley in 450 B.C. The annual production of beer was now about 36 million gallons, and the industry contributed £120,000,000 directly to the Exchequer, or 15 per cent. of the total national revenue.

The chairman announced that the annual meeting of the Section would be held on March 17, and that he would give an address on "Chemical Industry in Bristol."

MANCHESTER.

The fifth meeting of the session was held at the Textile Institute, Manchester, on February 4, Mr. John Allan presiding. A paper on "The Utilisation of Subsidiary Alkaloids," by Prof. F. L. Pyman, was read, in the author's absence, by the Hon. Sec., Mr. L. Guy Radcliffe.

In the paper Prof. Pyman briefly outlined the general process for the isolation of alkaloids. Consideration was given to the stereochemical differences existing among certain alkaloids and special reference was made to atropine and the lævo form of hyoscyamine, an explanation being given of the transformation of the latter into the former. Reference was also made to pilocarpine and its relationship to iso-pilocarpine, and details were given of the chemical methods used for the methylation of the hydroxyl group and of the amido group, as well as methods of hydration in the case of ergotinine.

A considerable portion of the paper was devoted to the esterification of ecgonine obtained from the erythroxylon coca bean, and it was shown how the lesser valuable alkaloids could be easily and technically converted into the valuable cocaine. Reference was also made to the opium alkaloids, and especially to the utilisation of narcotine and papaverine. The optically active varieties of the styptic adrenaline, and the constituents of the *Hydrastis Canadensis*, better known as the Golden Seal, were described, and special emphasis was laid upon the value of the main substance hydrastine as compared with berberine, the latter being of little or no medicinal interest.

AMERICA.

The Perkin Medal for 1921 was presented to Dr. Willis R. Whitney at a meeting held at the Chemists' Club, New York, on January 14, Mr. Sumner R. Church, chairman of the Section, presiding. Dr. C. F. Chandler, senior past-president of the Society in America, in making the presentation, outlined Dr. Whitney's career, alluding more particularly to his work as Director of the Research Laboratory of the General Electric Company at Schenectady, N.Y., a post he has held since 1900.

In electric lighting the first radical improvement in the carbon incandescent filament was due to Dr. Whitney's personal work. The "metallised" filament, or "Gem" lamp, which he developed, gave 25 per cent. more light for the same wattage than the standard carbon-filament lamp. Millions of these new lamps were sold in a single year. A little later the laboratory solved the problem of mechanically working tungsten, and showed how to make the drawn wire which has given the tungsten lamp its universal application. The latest achievement of the laboratory in incandescent lighting is the gas-filled, or half-watt, lamp, which in its larger sizes has twice the efficiency of the vacuum lamp, and nearly equals the most efficient arcs. In arc lighting the magnetic electrode has been developed, and with it the most successful arc lamp of to-day. The laboratory has produced many new insulating materials and alloys, new processes, like "Calorising," for giving metals protective coatings; new articles of manufacture like "sheath wire"; new materials like "water japan" and "Genelite"; new electric furnace products like boron carbide, useful as a flux in casting copper, and titanium carbide for arc-lamp electrodes; new laboratory apparatus, such as the Arsem vacuum furnace, the tungsten tube furnace, the Langmuir condensation vacuum pump, the Coolidge X-ray tube, etc. Dr. Whitney was president of the American Chemical Society in 1910, and president of the American Electrochemical Society in 1911. He was awarded the Willard Gibbs Medal in 1916 and the Chandler Medal in 1920.

Dr. W. R. Whitney then acknowledged the honour which had been conferred upon him and gave an address on "The Biggest Things in Chemistry," which contained, among other things, the following dicta:—

In America patents are granted only to individuals, not to companies or laboratories, although the discoveries upon which they are based are often the result of corporate work. In this instance the award is to be regarded as belonging not to the recipient but to the research laboratory which he directs. Perkin's life contained all the data needed to analyse scientific research, and illustrates the fact that the great advances have usually been made by men trained in their particular line of investigation and working just beyond the boundaries of the known. Perkin's apprenticeship under Hofmann so imbued him with the spirit of scientific research that after years of commercial success he returned to it and enjoyed it for the rest of his life. The essentials for success appear to be the teacher of heuristic instinct, the laboratory, and the school training. It is incorrect to say that Perkins, Faradays, and Pasteurs are born, not made, for the process is entirely standardised. American schools have been working on the wrong lines, and instead of turning out men well trained in research they have been consuming energy in bringing large numbers of men only part of the way.

No two chemists would agree at first as to what constitute the most important things in chemistry, but on reflection many would admit that the biggest things are summed up in the word "possibilities." Chemistry has grown and survived because all its precepts and principles can be re-tested at any time and anywhere. It is a young science, but its rate of advance is almost incredibly rapid, and one feels that no one has ever had such possibilities open to him as the present-day student of chemistry. The process Perkin followed is that which has led to most of our discoveries; it is the encouragement of natural inquisitiveness under the best conditions; no short-cut and easy process would have produced dyes from tar. One of the biggest things in chemistry to-day is to learn how to make the teaching of chemistry *productive*, and a study of the lives of such men as Wöhler and Pasteur should conduce to this end. They teach the value of high training combined with faith, a combination seldom found in the individual American.

In inorganic chemistry the number of available metals has been doubled within a few years, so raising to the *n*th power the number of possible alloys. Many of these metals are coming into use. The isolation of calcium is less simple than that of zinc, copper, iron, or tin, and its properties are different, but as usual it is the differing properties which determine the new uses. During the war it was used as a generator of hydrogen to maintain a very high pressure of this gas inside certain deep-sea sound-detecting devices, the sea water itself acting as the other reagent. It is also used as a continuously reacting purifier for argon in the "Tungar" rectifier, which consists of a bulb made of a special new glass, a spiral of tungsten wire, an electrode of artificial graphite, a little argon, and some metallic calcium.

In the sphere of organic chemistry, is it not possible that a field will be developed directly from carbon itself as great as that of dyes from coal tar? The gates thereto were apparently opened when calcium carbide was first made; and when we reflect that this substance made possible the manufacture of acetone, alcohol, etc., we realise the possibility of making, by the same road, useful food as certainly as medicaments.

In agriculture we are attracted by the thought that our troubles with nature are sometimes due to our personal limitations, not to the limitations of nature; and there appears to be a fertile field for research into ways and means of reducing the amount of human labour expended upon the growing of crops. Some of the biggest things in chemistry are coming from research in biochemistry and hygiene.

The remainder of the address was an elaboration of the thesis that the spirit of research and the quest for truth in the experimental investigation of material phenomena lie at the very roots of human progress, both material and ethical.

LONDON.

At a meeting held on February 7, at Burlington House, with Mr. Julian L. Baker in the chair, a paper on "The Erosion of Bronze Propellers" was read by Dr. O. Silberrad. Recent investigations by a sub-committee of the Board of Inventions and Research have confirmed the author's previous conclusion that the deterioration of bronze propellers is due to mechanical causes. However, the Committee's conclusion that erosion is due almost exclusively to the collapse of vacuum bubbles ("water-hammer action") is not in agreement with the author's results, which show that after the surface of the metal has been damaged by this action further erosion is chiefly caused by frictional rub of the water.

Chemical analysis of the eroded portions of propellers shows that the composition of the eroded alloy is unaltered. Slight etching extending over considerable areas of the metal, which is sometimes observed when the propellers first come out of the water, is due to frictional rub and can be produced by high-pressure water jets impinging upon the surface of the metal. A determination was made of the daily loss of weight of a portion of a propeller exposed to the action of sea water, and it was inferred that over 5000 years would be required to produce by chemical action the excessive erosion frequently observed. The effects of electrical currents due to leakage and to mechanical stresses set up in the metal were found to be negligible. Microscopic examination of eroded propeller surfaces and sections showed deformation and breakage of the crystals composing the α constituent of the alloy, whilst those of the β constituent were practically unaffected. Macroscopic examination showed that the majority of eroded propellers were either small ones running at high speed or large ones transmitting great power, and that the presence of dirt in the castings was without effect. Investigation of many eroded propellers enabled a classification to be made based upon the location and extent of the areas eroded, each type being traced to conditions producing currents of water containing vacuum bubbles impinging upon the affected areas. Since the α constituent of propeller alloys was found to be much less resistant to erosion than the β constituent, the author investigated the production and properties of new alloys, but found that a copper-zinc brass possessing only β structure possessed undesirable mechanical properties. By the addition of small percentages of other metals an alloy with homogeneous β structure was obtained which had all the good mechanical properties of the older bronzes, and propellers made of it were found in practice to be very resistant to erosion.

MEETINGS OF OTHER SOCIETIES.

SOCIETY OF PUBLIC ANALYSTS.

At the annual meeting held on February 2, Mr. A. Smetham delivered the presidential address and officers were elected for the ensuing year.

Mr. J. L. Baker and Mr. H. F. E. Hulton described an iodometric method of determining the diastatic power of malts in which use is made of the quantitative oxidation of maltose to maltobionic acid by iodine in presence of sodium hydroxide. Results obtained on the same samples by this method and by that of Ling were given. The advantages claimed for this method are the greater accuracy with which the iodine titration may be carried out as compared with Fehling's solution, the elimination of an external indicator, and the possibility of using artificial light for the final titration.

In a paper describing experiments on the use of extract of red squill (*Scilla maritima*) as a rat poison, Mr. F. W. Smith showed that the most effective form was that prepared in water from an alcoholic extract of the fresh bulb of red squill, and that salicylic acid could be used as a preservative without fear of hydrolysing the glucoside.

A paper on the composition of Harrogate mineral waters, by Mr. W. Lawson, contained a summary of the analyses carried out in connexion with Prof. Smithell's survey of these waters, analyses dating back some 90 years being also given for comparison.

THE ROYAL INSTITUTION.

The first Friday Evening Discourse of the new session was delivered on January 28 by Prof. Sir James Dewar on "Cloudland Studies." The first part of the lecture was devoted to experimental illustrations of natural cloud effects produced with the aid of liquid air or liquid oxygen. This was followed by a discussion of the early work on solar radiation by Sir J. Leslie, D. Forbes, and Pouillet, and of the determination of the "solar constant," that is, the amount of heat energy measured in gram-calories which would impinge vertically on 1 sq. cm. of the earth's surface provided there were no intervening gases to intercept the rays. With the aid of his pyrheliometer, Pouillet did very accurate work, his value for the constant, 1·76, being within 10 per cent. of the result of the latest determination (1·93) by C. G. Abbott and his staff in America. Leslie and Pouillet also determined the zenith or black-body temperature of the sky, using different methods, but these early investigators were ignorant of several disturbing factors, such as the variation of the wave-length of the emitted energy with temperature. The maximum wave-lengths of the black-body radiation emitted at the respective temperatures of boiling water, solid carbon dioxide, boiling oxygen, nitrogen, hydrogen, etc., were given in a diagram which showed that at the lowest temperature yet attained with liquid helium—2° A.—the wave-length of the radiation should be 1465 μ or 1·465 mm. The original investigators were also ignorant of the transparency of gases and liquids to different radiations, and in this connexion the lecturer performed an experiment to show that liquid air is diathermanous to low-temperature radiations, and described how he had used his thermoscope, which is based upon this principle (*cf.* J., 1920, 35 R), to determine zenithal temperatures on the roof of the Royal Institution, the lowest value obtained being −42° C., in June last.

Observations made in America have indicated that the solar "constant" varies within about 5 per cent., a conclusion which was strikingly confirmed last year by Guthnick at the Berlin Observatory, who found that the variations in the intensity of the light reflected from Saturn were within 1 per cent. of the variations of the solar constant observed in America.

Dealing with the composition of the upper atmosphere at the end of his lecture, Sir J. Dewar stated that as yet we had no proof of the hypothesis that it consists of hydrogen and helium (and perhaps methane and traces of water-vapour), but the recent work of R. H. Goddard, of Clark University, Worcester, Mass., "On a Method of Reaching Extreme Altitudes" promised to solve the problem. Goddard's method consists, briefly, in sending up rockets containing multiple charges of very powerful nitro-explosive which are fired successively from the same combustion chamber. By this means a velocity of 7000 ft. per sec. can be obtained, and it should be possible easily to reach altitudes up to 50 miles. Theoretically, 200 miles should be attainable with 10—12 lb. of explosive, and 500 lb. of explosive should project the rocket into space.

It should not be difficult to obtain samples of the upper atmosphere by attaching to the rocket a suitable air collector, a mechanism to buoy it up for a short time at its maximum height, and a parachute to make it descend slowly. The efficiency of the Goddard rocket is about 50 per cent.

CORRESPONDENCE.

ORIGIN OF THE SOCIETY OF CHEMICAL INDUSTRY.

Sir,—With reference to Mr. D. de L. Herman's letter in your last issue, I had always regarded Mr. G. E. Davis as primarily responsible for the formation of the Society. I recall that while I was an assistant in the Chemical Department at Owens College, about the year 1879, there were frequent visits from Mr. Davis to Dr. Roscoe, and these visits no doubt related to negotiations, the objective of which was the formation of the Society of Chemical Industry.

The passage given below from the "Life and Experiences of Sir Henry Roscoe" (Macmillan and Co., 1906) explains these visits, and shows that the formation of a national rather than a local Society was advocated by Sir Henry, and thus the movement was given that broader outlook which has resulted in the present day world-wide extension of the Society. Speaking of the earlier enthusiastic workers, I would suggest that the name of Mr. Walter Weldon be added to those mentioned by Mr. Herman.

"The Society of Chemical Industry was founded in 1880. It originated with a few men interested in the Lancashire chemical trade, notably Eustace Carey, Ludwig Mond, and Edmund Muspratt. It was originally proposed that the Society should be a local one, the object being to bring together purely scientific men and those practically engaged in chemical industry in the Lancashire district. I felt strongly the importance of such a proposal, but I thought that if the thing were worth doing at all it should be a national and not a local institution. I gradually obtained adherents to this view, and the Society was founded on these lines. The first list showed that we had obtained already 360 members; at the present moment the numbers are over 4000. The history of the Society during the quarter of a century which it has existed has been one of constant progress and success, and its influence is felt not only in this country and our Colonies (Canada and Australia), but also in America, where we have one Section in New York and another in Boston.

"I was elected the first president, and many distinguished chemists, both scientific and industrial, have succeeded me in the presidential chair. The work which the Council has done in publishing a journal under the able editorship of my old pupil, Mr. Watson Smith, has been beyond praise."

Of the existence of the Faraday Club in Liverpool or of its activities I was not aware. It has an interest inasmuch as it shows that the example of the Tyneside chemists had spread to the Lancashire district. For in 1868 there was founded the Newcastle Chemical Society, of which Mr. I. Lowthian Bell, afterwards Sir Lowthian Bell, was the first president, and among his successors were the late Sir Joseph Swan, Dr. Lunge, and others well known to chemical industry. This society was active until 1893, when it was dissolved and transformed into the Newcastle Section of the Society of Chemical Industry, forming, in fact, the third Section of this Society.—I am, Sir, etc.,

P. Phillips Bedson.

Newcastle, Feb. 5, 1921.

PERSONALIA.

Sir Robert Robertson, Director of Explosives Branch, Research Department, Woolwich, has been appointed Government Chemist in succession to Sir J. J. Dobbie.

Dr. R. Anschütz is to retire from the chair of chemistry in the University of Bonn at the end of March. The chairs of pharmaceutical and organic chemistry in the Czech University at Prague have been filled by the appointment of Dr. Sterba-Böhm and Dr. Plzak respectively.

The first triennial award of the Kelvin Gold Medal has been made to Dr. W. C. Unwin for his pre-eminence in the branches of engineering with which Lord Kelvin's scientific work and researches were closely identified. The medal was established in 1914 as part of a memorial to the late Lord Kelvin and in association with the window placed in Westminster Abbey to his memory by British and American engineers.

The death is reported from Paris of Prof. E. E. Bourquelot, who served forty-four years in the Faculty of Pharmacy and twenty years as general secretary of the Society of Pharmacy, Paris.

NEWS AND NOTES.

FRANCE.

Industrial Notes.—*Metallurgy.*—The most important event of the past fortnight has been the dissolution of the Comptoir Métallurgique de Longwy with its subsidiary Le Comptoir d'Exportation des Fontes de Meurthe et Moselle. In well-informed circles this dissolution is held to be the outcome of the restoration to France of Lorraine. Prior to the war the "Comptoir" had absorbed practically all the French producers of cast iron; but owing to post-war changes a complete re-organisation became necessary, with Lorraine in the foreground. As co-operation could not be achieved, the "Comptoir" concluded that it could no longer maintain the leading position it formerly held, by virtue of which it suppressed intermediaries, secured the necessary *clientèle* for members of the syndicate, and distributed orders among the different works in such a way as to minimise distances between the producing centre and the client. All such co-ordination tended to diminish cost prices. It is anticipated that this syndicate will soon be resuscitated in some new form and on an enlarged basis.

Coal.—The present surplus of coal is due less to improved production than to the industrial slump; it is probably purely temporary, and when trade revives accumulated stocks will quickly disappear. It is rumoured that Germany will notify the Reparations Commission that her present supplies to the Allies are so crippling her economical and industrial position that she will not be able to supply the 2,200,000 tons stipulated for 1921, nor the arrears of 500,000 tons for 1920 due in January and February of this year. In order to find outlets for coal when control is removed, agencies are to be opened at Paris, Nancy, Strasbourg, Châlons, and Dijon for the coal raised in the Saar district. There will also be an agency in Switzerland.

Chemical Industry.—German competition is increasing and becoming more open not only in chemicals but also in plant and laboratory appliances; and the differences in price are so great that efforts to resist it are unavailing. Thus thermometers, balances, etc., are being offered at prices 33—50 per cent. below French prices and are being delivered within three weeks instead of the 12—18 months required by French makers.

Great surprise has been caused by the announcement that La Compagnie Nationale de l'Azote, which is an offshoot of La Compagnie Nationale des Matières Colorantes, of Les Etablissements Kuhlmann, of La Société des Produits Azotés, etc., is going to use the "Badische" method of producing synthetic ammonia instead of the Claude process which is giving very satsfactory results at the Grande Paroisse Works at Montereau.

A credit of 150,000 francs has been voted by the Chamber for producing resin under Government control in the State forests of south-western France, in the vicinity of Bordeaux.

The production of the Alsatian potash mines in 1920 shows a notable increase. The quantity sold amounted to 200,000 tons of pure potash (K_2O), which represents one-fifth of the world's production in 1913.

Glass-making firms in France and in Belgium are very strongly affected by the present bad conditions in trade and by German and Italian competition. Several works have had to dismiss employees.

Manufacture of Paper from Alfa Pulp.—So far the United Kingdom has been the only country to use alfa, a product of French North Africa, for the manufacture of paper, but now, as a result of successful experiments, a French company is to be formed to produce the pulp. It is intended to acquire part of an explosives factory, situated near Avignon on the Rhone, and after 18 months to treat some 30,000 tons of pulp annually. The raw materials will be entirely of French origin, and the pulp produced will be dry, thus effecting economy in transport. Cellulose made from alfa is said to be suitable for the manufacture of smokeless powder. The exports of alfa from Algeria in 1917 were valued at 7,816,342 francs, of which the United Kingdom took 92 per cent., the share of France being less than 1 per cent. (*cf.* J., 1918, 301 R, 476 R).—(*Bd. of Trade J., Jan.* 13, 1921.)

AUSTRALIA.

Western Australia.

Porcelain Works.—Arrangements have been completed for initiating the manufacture of porcelain in Australia. In April next the Calyx Porcelain Co., Perth, will start erecting works at Subiaco which will cover three acres of land. Machinery to the value of £5000 has been purchased, and fifteen expert workers have been engaged.—(*Official.*)

Petroleum Exploration.—According to papers laid before the Parliament of Western Australia, the Anglo-Persian Oil Co., Ltd., has offered to form a Western Australian company with a capital of £100,000, of which £50,000 would be available for geological survey and boring. The company asked for legislation to be introduced next session to enable it to acquire leases of not less than 100,000 acres in the aggregate. The State Government acceded to the request for immediate legislation but would not consider leases larger than 600 acres each, to which the company replied that it was willing to explore for oil in Western Australia, but required large concessions similar to those granted to it in other parts.—(*Official.*)

Queensland.

Wolfram and Molybdenite Mining.—In order to save the wolfram and molybdenite mines near Cairns, the Chamber of Commerce of Cairns is urging the Commonwealth Government to acquire the properties as a national asset. During the war the deposits were exploited and the concentrates were shipped to the United Kingdom.—(*Official.*)

The Sugar Industry.—The twentieth annual report of the Bureau of Sugar Experiment Stations, issued December, 1920, states that never in the history of sugar growing in Queensland has there been so large an area under cane. The spring has opened up most favourably, and the prospects for next year are highly promising. Last year the yield of sugar from the cane attained a record, and this year it is also good, viz., about one ton of sugar from eight tons of cane, equivalent to a total yield of 163,000 tons.—(*Official.*)

Tasmania.

Electrolytic Zinc.—The Electrolytic Zinc Co. of Australasia is making large additions to its plant at Hobart, where 1200 men are now employed. It is anticipated that the company will shortly be able to export annually 10,000 tons of zinc oxide, 15,000 t. of zinc-lead oxide, 10,000—15,000 t. of lithopone, large quantities of rolled zinc sheets, and metallic silver and lead. The present output of zinc is 25 tons per day, and by November next this should be increased to 50—60 t. The current consumption is now 5700 h.-p., but when the full 30,000 h.-p. contracted for is available, the plant will be able to treat 100,000 t. of zinc concentrates per annum. Extensive warehouse and wharfage facilities are being supplied in order to cope with the expected increase in the export trade.—(*Ind. Aust. and Min. Stand., Nov.* 25, 1920.)

According to the *Times Trade Supplement* of Feb. 5, the above-named company has decided to cease production pending the increase of the plant capacity to 50 tons. The heavy fall in the price of spelter has led to this decision.

CANADA.

Projected New Paper Mill in British Columbia.—Plans are now practically complete for the erection of a large modern pulp and paper mill, to employ 1000 men, at Prince George, B.C., at a cost of $6,000,000. The capital is being supplied by interests in Eastern Canada and the United States.—(*Official.*)

Electric-Steel Smelting in British Columbia.—A new company, the British Columbia Steel Works, Ltd., has been formed to amalgamate the electric steel plants at Port Moody, Eburne, and Tudhope. For the present the three will continue operating, but later the work will be concentrated at Port Moody.—(*Official.*)

"Canadian Chemistry and Metallurgy" is the new title of *The Canadian Chemical Journal*, which has been chosen mainly because the older name too closely resembled that of various foreign journals that cover somewhat different fields—for example, specialised research. It is also announced that an additional paper, to be called *Canadian Dyer and Color User*, will shortly be isued from the same office.

SOUTH AFRICA.

Industrial News Items.—Asbestos deposits in the Haenertsburg District, Transvaal, are to be worked by the South African Asbestos Mines, Ltd., a newly-formed company with a capital of £50,000.

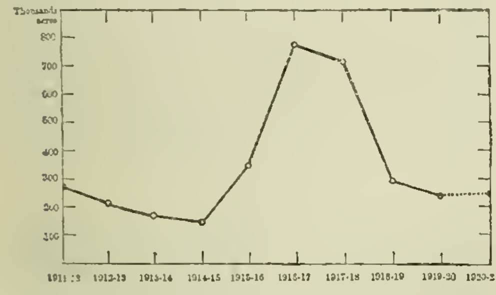
The fifth annual exhibition of the Chemical, Metallurgical, and Mining Society of South Africa, to be held at Johannesburg from March 9 to 21, will illustrate the latest developments in apparatus and machinery connected with chemistry, metallurgy and mining, and a section will be devoted to crude and manufactured products of the country.

The production of compressed oxygen and hydrogen will shortly be undertaken at Newtown, Johannesburg, by the Hydrogen, Oxygen and Plant Co., which will also make ammonia coils, condensers, etc., for refrigerating plants and undertake the welding of metals. A large works with two gasometers having a storage capacity of about 8000 cb. ft. is being erected at a cost of £35,000, and the plant will include 50 large cells capable of producing 3 million cb. ft. of gases yearly.—(*S. Afric. J. Ind., Dec.*, 1920.)

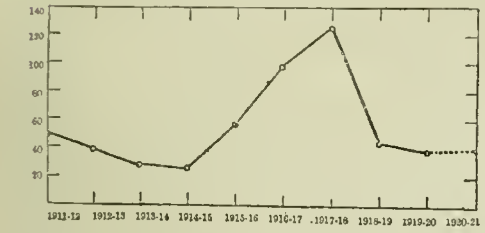
BRITISH INDIA.

The Indigo Industry.—The final general memorandum on the indigo crop for 1920-21, given in the *Indian Trade Journal* of December 31, 1920, states that the estimated total area under indigo is 238,400 acres, and the total yield 40,400 cwt., representing increases of 1·3 and 7 per cent., respectively, over the finally revised estimates of last year. The season was unfavourable, except in Madras, and the condition of the crop was reported to be fair. Of the total area under indigo in British India, 54·3 per cent. is in Madras (106,800 acres), 20 per cent. in the United Provinces, 14·7 per cent. in Bihar and Orissa, 9·3 per cent. in the Punjab, 1 per cent. in Bengal, and 0·6 per cent. in Bombay and Sind. The accompanying charts show the variations in the present figures of area and yield as compared with the finally revised figures of the last nine years.

Area under Indigo (in thousands of acres).



Yield of Indigo (in thousands of cwt.).



The exports by-sea to foreign countries in each of the last five years have been (in cwt.):—1915-16, 41,932; 1916-17, 34,230; 1917-18, 31,062; 1918-19, 32,707; 1919-20, 32,687.

The imports of synthetic and natural indigo into the United Kingdom during the last five calendar years have been:—

	Synthetic indigo.	Indigo.	Total.
1915	11,240	25,157	36,397
1916	4618	30,527	35,145
1917	11,966	13,501	25,467
1918	2084	5287	7371
1919	2466	3701	6167
1920	4541	1603	6144

Of the total amount of natural indigo imported into the United Kingdom in 1919 (3701 cwt.), 2857 cwt. came from India, 445 cwt. from San Salvador, and the rest from other countries.

UNITED STATES.

A Museum of Chemical Types.—It is announced that the Smithsonian Institute has accepted the bequest of $25,000 left by Morris Loeb, chemist, for the establishment of a "Loeb collection of chemical types," which will include specimens of all new chemical substances and make them available to research workers for reference purposes. An advisory committee of chemists will be formed to deal with requests for the use of type material from the collection.—(*Oil, Paint and Drug. Rep., Jan.* 3, 1921.)

Potash in 1919.—The situation in the potash industry was very serious at the beginning of 1919. The high prices ruling during the war period had resulted in an increase of the annual output capacity to 100,000 short tons of pure potash (K_2O), and the invested capital was estimated at $25,000,000. Few of the larger plants had been paid for, and many were still under construction or had only been operated for a short time. One-third of the 1918 production was still unsold, prices had dropped from $5 per unit in November, 1918, to about $2·50, and the market was dull. Hence most of the producers closed down, at least temporarily, early in 1919, and some went out of business. Efforts were made to induce Congress to pass protective legislation but without success. As, however, imports remained small, prices were maintained and domestic output was readily absorbed.

Production in 1919 amounted to 110,243 short tons (28% K_2O) from 77 plants, compared with 207,686 t. from 128 plants in 1918. The alkali lakes of western Nebraska again provided the largest supply, but the output from the alunite deposits in Utah diminished, and the extraction from silicate rocks in Wyoming was suspended owing to technical difficulties. Only one kelp plant in addition to the experimental plant of the Bureau of Soils at Summerland, Calif., reported production. The Government has continued its experimental work, and the Bureau has made a survey of the occurrence of borax in potash materials. Few developments occurred in the production of potash from molasses-distillery waste, beet-sugar refineries, or wood ashes, and no production from wool washings was reported. The total production in 1919 was constituted as follows:—Nebraska lakes 29·2%, other brines 36·6%, Steffens waste water 11·7%, molasses-distillery waste 9·1%, alunite 7·4%, cement works 3·8%, wood ashes 1·2%, blast-furnaces, kelp, and silicate rocks 1·0%. Exports were very small, and imports amounted to 39,619 short tons (K_2O), compared with 7957 t. in 1918, and 270,720 t. in 1913.—(*U.S. Geol. Surv., Dec.* 8, 1920.)

Maize Oil.—Bulletin No. 904 of the U.S. Department of Agriculture contains an account by A. F. Sievers of the production and utilisation of corn (maize) oil in the United States, where it has been manufactured on a commercial scale for about 25 years. The production in 1918 was 49,545 long tons, of which about 70 per cent. was refined for edible purposes.

The oil is derived from the germs, which represent about 10 per cent. of the weight of the grain and contain about 50 per cent. of oil; the inclusion of the oily germ in the various products of maize-milling renders the latter liable to become rancid, so that removal of the germ is desirable; this is carried out on a large scale, though whole grain is still milled, particularly in the Southern States. Degermination is effected by dry-milling in the manufacture of hominy products (grits, flakes, meal, and flour) and by the wet process in the manufacture of starch and glucose.

In the dry process the cleaned grain is sprayed with water and treated with steam till it contains about 20 per cent. of water, and is then passed through a degerminating machine, consisting essentially of a drum tapering horizontally, studded with cone-shaped projections and revolving at 700 revs. per minute inside a casing with similar projections; in passing through the machine the kernel is torn and shredded, the husk and germ are loosened, but the starchy portions of the grain are not ground appreciably. After separation of the various products the germs are dried until the moisture content is about 14 per cent. In the wet process of degermination the grain is steeped for 36—40 hours in a 0·2 per cent. solution of sulphurous acid in wooden vats, which are in some cases arranged so that the steeped grain can be removed from the bottom of the vat and fresh grain charged in continuously. The steeped grain is then drained and passed through mills which shred it, loosen the husks from the endosperm, and free the germs. The latest type of wet-degerminator consists of two circular vertical plates mounted (inside a casing) on a horizontal axis. Only one plate is geared to motor and revolved; in earlier types both plates were revolved.

The shredded grain is mixed with a large bulk of water and run to floating-vats, where the germs rise to the surface and pass over the end of the vats together with starch, which is removed by washing in perforated reels; the wet germs are then pressed to remove excess moisture, and finally dried to about 15 per cent. of moisture in steam-heated rotary driers.

Germs produced by the dry process are mixed with a good deal of the other portions of the grain; they contain an average of about 18 per cent. of oil and yield a cake with 5—7 per cent. of oil; wet-process germs, being more completely separated, contain about 45 per cent. of oil and yield a cake with 8—12 per cent. of oil.

The processes of oil-crushing and refining are similar to those used for other oil-bearing materials, though it is of interest to note that hydraulic presses have been almost entirely replaced by expellers which are more economical to run, partly owing to the present high cost of press-cloths; solvent extraction is sometimes employed. The oil cake is generally mixed with other products of maize-milling and sold for feeding purposes.

Crude maize oil is usually of good quality and low acidity, oil from dry-process germs being in some cases suitable for edible purposes without refining, and the average free fatty acid content of oil from seven mills being 1·11 per cent. by the dry process and 2·39 per cent. by the wet process; the acidity may, however, rise much above these figures, and oil from the 1917 crop averaged nearly 10 per cent. owing to the grain having been immature.

Maize oil has been used for many purposes, one of the chief being in the manufacture of rubber substitutes; it is still employed in soap-making, but most of the oil now produced is refined for edible purposes, the demand for which is evidently increasing. The elimination of the brewing industry, which is a large user of maize products, may cause a decrease in the production of the oil, though the increased demand for "corn-sirup" and other sugars may lead to increased milling of maize.

Bauxite and Aluminium in 1919.—The quantity of bauxite marketed in the United States in 1919 was 376,566 long tons, valued at $2,201,747 at the mines, a decrease of 38 per cent. in quantity and 36 per cent. in value compared with 1918. Arkansas, with an output of 333,490 t., was the chief producing State. The domestic bauxite marketed was utilised as follows:—For aluminium 272,270 t., for chemicals 67,842 t., for abrasives 35,395 t., and for refractories 1059 t. Imports of bauxite amounted to 6082 t., and exports to 17,701 t. Aluminium production, valued at $38,558,000, showed a decrease of 6 per cent. compared with 1918, which was due to accumulation of stocks. It is reported that plants for producing both aluminium metal and manufactured articles have been extended. The Aluminium Co. of America is building new plate mills at Alcoa, near Maryville, Tenn., and is enlarging the mills at New Kensington, Pa. Plants for making aluminium foil and powder have also been enlarged. There are now 23 plants producing aluminium sulphate, of which five are at municipal works. The total output of aluminium sulphate in 1919 was 200,034 short tons, and the average price was $33·80 per ton; three plants produced 4806 short tons of the chloride and 8 plants produced 17,091 t. of alums, mainly ammonium and sodium alums (*cf.* J., 1920, 288 R).—(*U.S. Geol. Surv., Aug.* 30, 1920.)

GENERAL.

The Association of Swiss Leather Chemists.—The Association Suisse des Chimistes de l'Industrie du Cuir was founded in 1918 as an independent association with objects similar to those of the Society of Leather Trades' Chemists. It has now about fifty Swiss members. At the last annual meeting, held in Lucerne in 1920, the Association decided, among other things, to take up the fight against the warble fly pest in Switzerland, and at a special meeting, held on January 15 last, the president submitted a scheme for the appointment of a Swiss committee to investigate this problem as part of the larger question of hide and skin deterioration. The scheme was accepted and a committee appointed. The Swiss Government and the Swiss Farmers' Association were represented at the meeting, and the president intimated that he had received a letter full of encouragement from the secretary of the Warble Fly Committee of the British Ministry of Agriculture and Fisheries. Another question discussed was that of official analyses in the leather trades, with a view to forming a special committee to study this subject in Switzerland, if necessary in collaboration with the existing committees of the International Associations.

The Dye Industry in Spain.—The Spanish coal-tar dye industry, centred in Catalonia, developed considerably during the war owing to the absence of German competition. Two old-established firms in Barcelona—J. Pellicer and L. Sagnier—are now producing Delta, Congo, and other standard colours on a competitive basis, but neither these firms nor any of those recently established can produce the special dyes for which Germany is famous. The most important new companies are the Sociedad Española de Productos Quimicos (*cf.* J., 1919, 32 R), which is supposed to control the market in Sulphur Blacks, and the Industria Quimica Nacional, which so far has only manufactured sulphuric and hydrochloric acids, etc., but is negotiating with German firms with a view to acting as their agents on the Spanish and South American markets. The Anilinas y Productos Quimicos company, of Barcelona, is reported to be closing its works, as it is unable to produce at a profit owing to lack of raw materials and *personnel;* and the Quimica Tarasense company mainly produces chrome colours from raw materials imported from America. Except in the case of the simple coal-tar colours, it may be said that the recent efforts of the Spanish industry have come to grief, and that German colours still retain their supremacy.—(*Z. angew. Chem., Nov.* 26, 1920.)

The Glass Industry in Lorraine.—The glassworks of Lorraine are situated at Dreibrunnen (near Saarburg), Chateau Salins, Forbach, St. Aurin (near Lörchingen), Götzenbruck, Meisenthal, and Münzthal (near Bitsch). The three last are the most important. The Münzthal works is now producing ordinary glassware, fancy wares being in small demand; it has the largest glass furnace in the world, with 24 pots. The Meisenthal factory, employing 500 men, has been doing well, and has recently spent 500,000 fr. on plant extensions, etc. The Götbenbruck factory is the largest spectacle-glass works in the world; it employs 800 men, but some of these have been dismissed owing to trade depression; it also manufactures watch and window glass. The Lorraine glass industry, although prosperous on the whole, has been affected by its isolation from the German market, and part of its trade has been lost to Germany and Japan.—(*Z. angew. Chem., Dec.* 24, 1920.)

German Chemical Industry in 1920.—During the first half of the year the production of chemicals was very seriously affected by shortage of raw materials and coal, and the foreign demand, stimulated by the low rate of exchange, could not be satisfactorily met. These conditions created a danger of German chemical firms coming under foreign domination. The large companies met the altered circumstances by making large increases in capital and at the same time drawing themselves into closer association. Owing to this increase, the total capital of the most important German chemical companies amounted to 1·9 milliards of marks at the end of 1920. The very sudden upward move in prices of chemical products in January-March gave rise to the most rampant speculation, but ended disastrously for both home and foreign speculators after the Kapp insurrection. It would have been much better if the development of the export trade had taken place more gradually, as the sudden violent demand could not be satisfied owing to want of coal. In the latter part of the year, when coal supplies began to improve, production could not be developed owing to difficulties in selling. Many foreign contracts were cancelled as the value of the mark rose, and the threat of a trade crisis, stimulated by the reported sudden drop in the prices of foreign chemicals, has persisted over the end of the year. In fact, the present year opens with prospects of a crisis more serious than any which has been experienced since the 1860's. There is a doubt whether recent dividends were justified, paper money has never been so depreciated, and never has the necessity for ample reserves to cover repairs and replacements been so vital. The dividends of 14 to 20 per cent which were declared in spite of the large and growing demands for State taxes and workers' wages, were designed to support the heavy increases in capital; they were only justifiable as a division of war profits, after writing off the cost of extensions and new plant.

Problems connected with the re-organisation of the chemical industries are being dealt with by the Reichsarbeitsgemeinschaft Chemie, Berlin; the most important of these was that of coal supplies, for owing to the deliveries due to Allied countries under the peace treaty the requirements of German industry could not be met by more than 50 per cent. at most. The coal-tar colour and soda industries, which employ, either directly or indirectly, over 8 million workers, were very hard hit. The Solvay works at Würselen and Rheinsberg were shut down in January for want of coal, and similar trouble extended through all branches of the industry during the whole spring, and only in the summer did any improvement set in. Closely dependent on the coal problem is the supply of raw materials such as coal-tar products, salt, lime, alcohol, etc. These created grave difficulties in the past year, and the prospects for 1921 are not much better, since large quantities of benzol, coal tar and ammonium sulphate have to be delivered to France under the agreement of January 10, 1920.

The question of the socialisation of the coal mining industry is a disturbing factor, and a resolution condemning the proposal was passed unanimously at a meeting of the chemical trades held at Munich in September. The tendency of the proposal is to reduce production in the mining industry and to increase prices, thus crippling the chemical industries in their endeavour to rehabilitate German trade and meet foreign competition in the world's markets.

The compulsory control of the chemical industry, which so rigidly enforced during the war, has now been abolished for internal trade, but it was resolved on November 24 that restrictions on the export trade should be continued for a time. In many cases export licences have already been abolished.

Wages and salaries were increased two- or three-fold over those paid in 1919, but recently difficulties and disputes have arisen in the attempt to reduce wages by 10—15 per cent. There is little sign of the hoped-for fall in the cost of living, and demands for further increases in wages must be expected.

Organisation in chemical industry has developed to a remarkable extent during the past year, and industrial scientific research has been furthered by the foundation of many new institutes and societies. The exclusion of Germany from many of the world markets makes it imperative that the development of her chemical industry should proceed on the lines of concerted action and high-quality production.—(*Chem.-Zeit., Jan.* 1, 1921.)

The Beet-Sugar Industry in Bulgaria.—As yet only beet sugar is produced in Bulgaria, but experiments with sugar cane are now in progress, and prospects appear to be favourable. Although the area planted to sugar beets in 1919 was only 21,414 acres, a decrease of 18,167 acres on the 1918 area, the total production was 11,861 metric tons, an increase of 8465 t. There are refineries in Sofia, Rustchuk, and Gorna Orchovitza, each with a capacity of 120 to 150 metric tons of raw sugar per 24 hours. No sugar is exported, but 4953 t. was imported in 1919, mainly from Czecho-Slovakia.—(*U.S. Com. Rep., Dec.* 6, 1920.)

The Mineral Output of Italy in 1919.—The Italian mining industry made considerable progress during the war, the number of workmen employed and the value of the production having increased from 46,412 and £3,860,000 (£1=25 lire) in 1914 to 58,871 and £14,790,138 in 1918, respectively. The chief mining districts are situated in the provinces of Caltanisetta (Sicily), Florence, Arezzo, Grosseto (Tuscany), Cagliari, Sassari, and Iglesias (Sardinia), whilst others of lesser importance are situated in the provinces of Bergamo, Brescia, and Turin. The full extent of the mineral resources of Italy is not known and an extended study is required. Details of the output of minerals and metals for 1918 and 1919 (in metric tons) are appended:—

	1913.	1919.
	Metric Tons.	
Minerals:—		
Iron ore and manganiferous iron	603,116	450,729
Manganese ores	1662	23,592
Copper ores	89,847	16,393
Lead ores	44,654	11,937
Iron and copper pyrites	317,334	372,474
Mercury (metal)	1004	548
Sulphur	406,406	226,126
Coal and lignite	701,079	1,158,542
Petroleum	6572	4851
Marble	509,342	265,744
Metals:—		
Pig iron	426,754	239,716
Iron and steel	933,500	731,823
Copper	2091	1243
Zinc	—	1282
Lead	21,674	16,530
Antimony	76	30
Aluminium	874	1,673

The total capital invested in the Italian mining industry at June 30, 1919, was £13,472,278.—(*Bull. Dept. Tr. and Com., Can., Nov.* 15, 1920.)

Dutch Guiana in 1919.—The production of gold is steadily declining, although dredging prospects in the Marowyne river are considered good. Bauxite mining is regulated by a new law, which provides for concessions lasting not more than 50 years and limits the area held by any one company or individual to 308,750 acres. Preparations for the mining and export of bauxite are going forward rapidly. Mercury has been found in a number of places near the Marowyne River, and in co-operation with the Government a Dutch company is exploring large areas said to contain deposits of high-grade iron ore. Balata production has decreased, in spite of good prices, and as areas worth exploiting are becoming more inaccessible from the coast, the industry is gradually passing into the hands of two or three large corporations.—(*U.S. Com. Rep., Suppl., Oct.* 4, 1920.)

The Mica Industry in Brazil.—H. M. Commercial Secretary at Rio de Janeiro reports that excellent sheet mica is produced in Brazil in the State of Minas Geraes (municipality of Pecanha). Large quantities of good-quality mica also occur in the State of Sao Paulo, in Iguape, Itapecirica, and in the Serra do Mar mountains. The development of the industry was formerly greatly handicapped by inadequate transport, but apparently this is now largely counterbalanced by increased working costs in India and elsewhere, and by the higher price of the product. The production of mica in Brazil has risen from 50·8 metric tons in 1915 to 154·35 t. in 1919.—(*Bd. of Trade J., Dec.* 16, 1920.)

Proposed Pulp and Paper Manufacture in Portuguese E. Africa.—H.M. Consul-General at Lourenco Marques reports that a concession has been granted to the Cia. Portuguesa de Papel Mocambique giving it the exclusive right to prepare pulp from native and foreign vegetable matter, and to manufacture paper and parchment in the province of Mozambique for a period of ten years. The company is to erect a factory at Ressano Garcia, near the Transvaal frontier, and utilise tambuki grass, and possibly wood, as raw material. The syndicate which holds the concession for the manufacture of pulp from baobab trees in the Quilimane and Tete districts has been unable to sell its products to paper-manufacturers in the United Kingdom, in spite of favourable technical reports. Some time ago it contracted to supply a Norwegian pulp company with 40,000 tons of material on a royalty basis, and since then it has received numerous inquiries from Germany and the United States.—(*Bd. of Trade J., Dec.* 16, 1920.)

A New Process for Drying Peat.—A company, the Oy. Hydroturve A.B., has been formed in Finland for the purpose of exploiting a new labour-saving process for drying peat. In the process the peat in the bed is reduced to mud by a jet of water under high pressure, and the mud is pumped on to a drying field by an electrically-driven pump fitted with a cutting apparatus. Roots, etc., are removed by means of a special device and, after drying, the mud is cut up into uniform sizes. Peat ("hydro-turf") prepared by this process, which is of Russian origin, is said to dry more quickly than ordinary peat.—(*U.S. Com. Rep., Dec.* 30, 1920.)

The Institute of Metals.—The annual general meeting of the Institute of Metals will be held on March 9 and 10 next at the Institution of Mechanical Engineers, Storey's Gate, Westminster. The meeting will commence on each day at 10.30 a.m., and the list of papers to be read includes:—March 9. "Stages in the Re-crystallisation of Aluminium Sheet on Heating, with a Note on the Birth of Crystals in Strained Metals and Alloys": H. C. H. Carpenter and F. Elam. "Some Notes on Calcium": P. H. Brace. "Plastic Deformation of Some Copper Alloys at Elevated Temperatures": C. A. Edwards and A. M. Herbert. "The Action of Reducing Gases on Heated Copper": H. Moore and S. S. Beckinsale. March 10. "The Season Cracking of Brass and other Copper Alloys": H. Moore, S. Beckinsale, and C. E. Mallinson. "The Constitution of the Alloys of Copper with Tin, Parts III. and IV.": J. L. Haughton. The annual dinner will be held at the Trocadero Restaurant on March 9, at 7.30, and on the afternoon of March 10 a visit will be made to the National Physical Laboratory, Teddington. As previously announced, the May Lecture will be given on May 4 by Prof. T. Turner on "The Casting of Metals."

It is announced that arrangements have been made for the publication of an index to the first twenty volumes of the Institute's Journal, and members are asked to notify the Secretary if they intend to purchase a copy, the price of which will probably be 10s. 6d. The next ballot list of applicants for membership will be issued on February 24, and applications should be sent in by the day before. Special concessions are offered to those who are elected members on the next ballot.

Lectures on Catalysis at the Royal Society of Arts.—A series of three Cantor Lectures will be delivered during February by Dr. Eric K. Rideal on "Applications of Catalysis to Industrial Chemistry." The syllabus is as follows:—

Lecture I. Feb. 14.—Introduction: classification of catalytic action: theories of catalysis; technical difficulties.

Lecture II. Feb. 21.—Processes of Oxidation:—Sulphuric acid: nitric acid: chlorine: catalysts in the gas industry: sulphur recovery: surface combustion: incandescent mantles: organic industries: formaldehyde: drying oils: linoleum: oxidation of hydrocarbons.

Lecture III. Feb. 28.—Processes of Hydrogenation:—Preparation and purification of hydrogen: methane: hexahydrobenzol: oil-hardening: synthesis of ammonia: the cracking of oils: synthetic rubber. Hydrolytic Processes:—Saponification: glucose: alcohol: acetic acid: acetone and ether.

The lectures begin at 8 p.m.

LEGAL INTELLIGENCE.

ALLEGED BREACH OF CONTRACT *re* SALE OF COAL-TAR PITCH. *Erlebach and Co.* v. *Gatty, Saunt and Co.*

In the Court of Appeal on January 21, Messrs. Gatty, Saunt and Co. appealed against a judgment of Mr. Justice Bailhache, awarding Messrs. Erlebach and Co. damages for alleged breach of contracts relating to the sale of coal-tar pitch. Plaintiffs (Messrs. Gatty, Saunt and Co.) contended that some of the pitch supplied was not coal-tar pitch, and was unsuitable for briquette manufacture, for which, to the defendants' knowledge, it was required, and for which they gave an assurance that it was suitable. Defendants denied having any knowledge that the pitch was required for the purpose stated, or having given any warranty, and did not admit that the pitch was not coal-tar pitch. Mr. Justice Bailhache found for the plaintiffs on both points, viz., that the pitch supplied was blast-furnace coal-tar pitch, and was therefore not good delivery; and that plaintiffs were told that the pitch was suitable for briquette manufacture.

In dismissing the appeal, Lord Justice Bankes, Scrutton and Adkin found that, although there was no well-known and accepted meaning of the expression "coal-tar pitch," blast-furnace pitch was excluded from the terms of the contract. Firms that stood high and desired to be beyond reproach would not sell blast-furnace pitch as coal-tar pitch. On the other hand, they were satisfied that plaintiffs had informed defendants that the pitch was required for briquette-making, and this implied a warranty. The judgment in plaintiffs' favour must therefore stand.

PUBLICATION OF A DESIGN. *Gunston, Green and Simpson, Ltd.,* v. *Winox, Ltd.*

In the Court of Appeal, on February 28, the Master of the Rolls and Lords Justices Warrington and Younger allowed an appeal by Messrs. Winox, Ltd., from a judgment of Mr. Justice Astbury, given at a suit of Messrs. Gunston, Green and Simpson, printers, of Farringdon Avenue, E.C.

By the judgment complained of Mr. Justice Astbury granted an injunction to restrain the defendants from infringing plaintiffs' design (a cardboard cut-out portraying a nurse carrying a tray with wine and bunches of grapes). Plaintiffs' case was that, having originated the design and applied for registration, they sold it to Liebig's, Ltd., for advertisement purposes, but that before any copies of the cut-out were delivered they found that defendants were using a design which they considered an infringement. Mr. Justice Asthury held that the manager of Winox, Ltd., having been shown the design in confidence, had something similar prepared to his order from other printers, and granted the injunction.

The Master of the Rolls, giving judgment, said he disagreed with Mr. Justice Asthury with regret, because he thought the defendants had played the plaintiffs a very dirty trick. But before the design was shown to the defendants, and before it was registered, it had been shown to another firm with the view of obtaining an order, and that constituted a publication within the meaning of the Patents and Designs Act, and enabled the defendants to escape the consequences of the conduct of their manager. The appeal must be allowed. The Lords Justices concurred.

REPORT.

Report on the Industrial and Economic Situation in Germany in December, 1920. *By* J. W. F. Thelwall *and* C. J. Kavanagh. *Pp.* 79. *Department of Overseas Trade. London: H.M. Stationery Office.* 1920. [*Cmd.* 1114. 9d.]

Although conditions in Germany have generally improved during the past two years, the state of public finance has become desperate owing to the ever-increasing issue of paper currency. In March, 1920, trade and industry were plunged into sudden stagnation, which still continues, although the critical stage is probably past. The high dividends paid for the year 1919 seem to suggest successful trading, but some of the satisfactory balance sheets were due to large payments by the State on completed war contracts. The outstanding features of the past year were the formation of combines and co-operation with foreign groups; the former movement has spread very widely, especially in the iron, steel, and coal industries. No official statistics of foreign trade have been published. The labour situation, as a whole, has improved, but it may revert in times of stress arising from failures due to losses in exchange consequent on falling world prices, or from increased taxation.

Complaints of the shortage of coal are not entirely confirmed by the published figures of production and distribution. Thus it was officially stated that the proportion of supply to requirements in August last, compared with that in August, 1913, was 64 per cent., but the issued statistics indicate 82 per cent. Only 88 per cent. of the coal requirements of the chemical industry is stated to have been satisfied in May, and 63 per cent. in August, 1920. Owing to the increased consumption of lignite (now 132 per cent. above that in 1913), alterations have had to be made in firing systems and greater space is required in transport; certain power stations, nitrogen plants, etc., use it exclusively. There have also been improvements in the utilisation of waste gases, peat, and other low-grade fuels. To sum up, although German industry is not abundantly supplied with coal, it is by no means threatened with annihilation from lack of fuel; difficulties are only temporary and coal production is improving.

The iron and steel industry has recovered rapidly and a measure of stability has been attained since April, 1920, when the Eisenwirtschaftsbund came into operation. As most of the iron ore consumed has now to be imported, attention will be directed more to working up iron and steel into the highest types of manufacture rather than producing semi-finished products, *e.g.*, pig iron, blooms and billets, as in the past. One of the most important combines (*cf.s.*) is the Rhine-Elbe-Union which controls a capital of over 500 million marks and employs 200,000 workers.

The non-ferrous metals industry has re-established itself on old lines. The aluminium industry is now controlled by the Vereinigte Aluminiumwerke A.-G. and has enjoyed a good export trade; home deposits of bauxite have been developed for chemical rather than metallurgical uses, and supplies formerly obtained from France are being derived from Dalmatia.

Little has been published of late concerning the chemical industry, and the dye industry in particular, save complaints about the coal shortage and the high cost of raw materials and labour—difficulties which have led to further amalgamations. Several Silesian firms have combined under the title "Chemische Werke Oberschlesien G.m.b.h.," with the object of working up their total production of tar, benzol, and ammonia. The chemical industry has survived the most critical stage after the war, and helped by its consolidation, organisation and experience, is trying to regain its old markets. The H. J. Sloman Saltpeter A.-G. (*cf.* J., 1920, 281 R) is to sell its overseas interests to the Salitrera Tocopilla company for 16,320,000 mk., its shareholders having the right to acquire an interest in the new company. In the early part of the year the potash industry improved, crude salts were in plentiful supply, but salts high in potash were scarce owing to exportation and lack of coal. Towards the autumn, the trade with America declined and Alsatian competition began to be felt. The consumption of pure potash (K_2O) in 1919 was 812,002·4 metric tons compared with 1,110,369·4 t. in 1913, and 1,001,664·3 t. in 1918, and the sales from January to October, 1920, were about 800,000 t. Sales of manufactured potash compounds have notably decreased. Whereas potash prices have risen by an average of only 441 per cent. since 1914, those of coal, iron, food and wages have risen by 1600, 2700, 1200 and 1000 per cent., respectively. As the home price of potash is below cost, extra profit must be made on foreign sales. Since 1918 a potash council (Reichskalirat) of a socialistic nature has been formed to enable employers, consumers, and workmen to meet and discuss conditions of labour, wages, etc. (*cf.* J., 1920, 100, 116, 132, 235, 274, 446 R).

The seed-crushing industry was in a serious position in September owing to stocks having become exhausted through official interference. Some German and Dutch firms are forming a company with a capital of 100 million mk. (*cf.* J., 1920, 445 R) in order to secure adequate supplies of fats and to overcome difficulties of exchange in purchasing raw materials; the purchases will be effected through the Dutch parent undertaking. Of the 102 mills associated with the German Economic Union of Oil-pressing Mills, a large majority is under foreign (mostly Dutch) influence.

An industrial organisation ("Reichswirtschaftsstelle für Kunstseide und Staplefaser"), in which makers, consumers, and employees have equal representation, was formed in November to regulate production, sales, and prices in the artificial silk industry, and its first action was to abolish State control. The production of artificial silk has so increased that it can now satisfy the home demand.

The report contains fifteen appendices giving statistical information relating to finance, fuel, wages, unemployment, industrial combines, foreign trade, etc.

OFFICIAL TRADE INTELLIGENCE.

(*From the Board of Trade Journal for January* 27 *and February* 3.)

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W. 1, from firms, agents or individuals who desire to represent U.K. manufacturers or exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department and quoting the specific reference number.

Locality of Firm or Agent.	Materials.	Reference number.
Canada	Chemicals, dyes, oils, glue, fertilisers, dry colours, whiting, precipitated chalk	123
„	Metals, leather, china, porcelain	154
„	Bessemer blue-annealed steel sheets	*
Egypt	Soap	163
„	Paper, bristol-board, ink, antimony, tin, pig lead (tenders for)	
South Africa	Paper	127
Belgium	Paint, varnish	132
„	Metallurgical products	133
„	Pitch	169
Norway	Leather	140
Switzerland	Black and galvanised sheets, tinplate	143
China	Linseed oil	174
Persia	Drugs, soap, window glass	176
United States	Barytes, lithopone, dry colours, cresylic acid	177
„	Mica	178
„	Glass, pottery, china, porcelain	181
„	Scientific and optical instruments	182
„	Earthenware, pottery	183
„	Pottery, tiles	184

* The High Commissioner for Canada, 19, Victoria Street, London, S.W. 1.

MARKETS SOUGHT.—A Canadian firm wishes to get into touch with U.K. importers of cyanide for the extraction of gold. [Inquiries to the Canadian Government Trade Commissioner, 73, Basinghall Street, London, E.C. 2.]

A firm in Ceylon and Southern India able to export medicinal plants, vegetable fibre, copra, rubber and oil-seeds wishes to hear from U.K. importers. [128]

TARIFF, CUSTOMS, EXCISE.

Australia.—Recent customs decisions affect iron and steel sheets, carbonate, bicarbonate and silicate of soda, and explosives.

Austria.—Customs duties when paid in bank notes must be paid at 50 times the rates prescribed in the tariff, as from January 1.

Belgium.—The conditions affecting the import and export of sugar are given in the issue for January 27.

Cocoa butter, salt, and soap may now be exported without licence.

British India.—The duty on opium imported into the Punjab and the North-West Frontier Province is fixed, as from April 1, at 36 Rs. per seer unless produced in any State under the control of the Punjab Government, in which case the duty will be 27 Rs. per seer.

Colombia.—Export of gold and silver is now permitted. The customs duties have been modified on, *inter alia*, alcohol, certain alcoholic beverages, and printing paper.

Denmark.—Export prohibitions have been withdrawn from oil-cake, margarine, vegetable oils for the manufacture of margarine, elco stock, oleo-oil, certain oil-seeds and oleaginous products.

Egypt.—The export of coal-tar derivatives suitable for the manufacture of explosives is prohibited.

The export is prohibited, except under licence, of crude alcohol, groundnuts, silver, butter, certain drugs, chemical fats, edible fats, cotton oil, sesame oil, yeast, gold, crude paraffin, molasses, sugar, and oil-cakes.

France.—The customs duties on certain kinds of paper have been reduced.

The prohibition of the export of pure vegetable oils has been withdrawn, but the export of oil-cake is still subject to licence.

French Equatorial Africa.—An export duty of 5 per cent. *ad valorem* has been levied on palm oil and palm kernels.

Italy.—The customs duty on mineral oils, except heavy oils, has been increased by 50 per cent.

Benzol and other light coal-tar oils for use as raw materials for the manufacture of artificial organic colours, varnishes or lacquers, may be admitted at the reduced rate of 2 lire per 100 kg. if denatured by specified methods.

Ammonium nitrate for use as a fertiliser may be admitted duty free if adulterated and upon proof of its use for this particular purpose.

The temporary suspension of the import duty on white paper, in rolls, for newspapers is extended until March 31.

The use of white phosphorus for the manufacture of matches, and the import of matches containing white phosphorus, are prohibited as from January 1. The import of white phosphorus for other uses is subject to the permission of the Minister of Finance.

The import of motor spirit, matches, saccharin, and sugar is reserved to the State.

Among the articles for which import licences are still required are glassware and perfumery.

The export of the following is prohibited:—Bricks, tiles, cement, charcoal, copra, animal and vegetable fats, feculae, margarine, condensed milk, fertilisers, metal scrap, certain metallic ores, nickel, newsprint paper, glucose, molasses, sugar, caramel, certain oils, various potash salts, pyrites, quinine, pure spirit, copper sulphate, tanning extracts, toluol, etc.

Japan.—The duty-free admission of mineral oils is only applicable to oils to be used for certain specific purposes, *e.g.*, the ceramic and metal-heating industries.

Memel Territory.—The customs *régime* is given in the issue for January 27.

Netherlands.—Export prohibitions have been withdrawn from engine and lubricating oil, fire-bricks, coal tar and its residues.

New Zealand.—As from December 1, 1920, packages containing cream of tartar substitute must be labelled with the name or names of the substances most generally understood by the public.

The prohibition of the export of sheep skins has been revoked.

Norway.—The import of alcohol is prohibited.

Portugal.—A revision of the Customs tariff is projected. The proposed new rates are not very different from the tariff of 1892, but the duties are leviable entirely in gold. Payment, however, may be made by means of "gold warrants."

South Africa.—Sugar imported from Belgium and Holland is subject to a surtax.

Spain.—The rate of surcharge on customs duties when paid in Spanish silver or notes of the Bank of Spain is fixed for the month of February at 45·03 per cent.

Trinidad and Tobago.—Articles subject to export tax include sugar, molasses, syrup, rum, cocoa, coconuts and copra.

COMPANY NEWS.

GAS LIGHT AND COKE COMPANY.

Speaking at the annual meeting on February 4, Mr. D. Milne Watson, the Governor, announced that the company would shortly sell gas on a calorific basis, and that the standard price would be 1s. 3·2d. per therm. The calorific value to be declared was 475 B.Th.U., and the actual price would be 1s. 2d. per therm, corresponding to the present price of 5s. 6d. per 1000 cb. ft. of gas. The sliding scale had now been re-established, but on a different basis, and it should be possible to raise the dividend from £3 to £4 13s. 4d. per cent. per annum. Mr. Milne Watson dealt at length with the reasons why the price of gas had recently been raised by 10d. per 1000 cb. ft., the chief of which was the very sharp decline in the price of residuals. He also reviewed in detail the events of the past year, stating that the output of gas had reached the record total of 32 thousand million cb. ft., that the number of customers had increased by 9000, and that the coal consumed had risen to over 2¼ million tons. Both the increased demand for gas and the good prices obtained for residuals (until near the end of the year) were satisfactory, but on the other hand the company had suffered from the rise in the cost of coal, the very high price of oil, the enormously increased wages bill, the necessity for spending large sums on repairs and maintenance, and the slump in the price of residuals following the coal strike. The company was extending its manufacture of intermediates in order to meet the new situation created by the passing of the Dyestuffs (Import Regulation) Act.

Amalgamation in the Photographic Trade.—An amalgamation has been arranged between the following firms:—Paget Prize Plate Co., Watford; Rajar, Mobberly, Cheshire; Marion and Co., Soho-square and Southgate; Marion and Foulger, Bedford; A. Kershaw and Son, Leeds; Kershaw Optical Co., Leeds; Rotary Photographic Co. (1917), West Drayton. The new company is called the "Amalgamated Photographic Manufacturers, Ltd.," and its authorised capital is £1,100,000, divided into 100,000 seven per cent. cumulative preference shares of £1 each, 600,000 ten per cent. participating cumulative preference shares of £1 each (250,000 of these are now being offered at par), and 400,000 ordinary shares of £1 each.

The British Cellulose and Chemical Manufacturing Co., Ltd., has received a report from Messrs. Clavel and Lindenmeyer, dyers, of Basle, Switzerland, describing the results of tests on the dyeing properties of the cellulose acetate silk made at Spondon. According to the report, this silk shows a remarkable chemical affinity for dyes, and no pretreatment is required even in the case of dyes insoluble in water. The Basic, Azo, Acid, Alizarin, and other dyes can be used successfully, and the dyed silk thus obtained is fast to light and wash proof; the basic dyes in particular show an unusual fastness to light. Weaving tests have shown that the great elasticity of the silk enables it to be worked through the loom with ease, whether used as warp and weft, or as one of these, or in conjunction with natural silk; those responsible for these tests remarked on the absence of breakages and called attention to the fine "scroop" and rich appearance of the product.

British Cyanides Co., Ltd.—An extraordinary meeting was held on February 9, at which certain arrangements proposed by the directors relating to the development of the barium cyanide process of fixing atmospheric nitrogen were approved. The experimental work connected with this process has been done by the Oldbury C.S. Syndicate, an offshoot of British Cyanides Co., Ltd., and the main difficulty of obtaining the right kind of furnace is now believed to be overcome by a new furnace designed by Arthur Duckham and Co. An agreement between this company and the Syndicate is now to be signed which gives the latter, *inter alia*, an exclusive licence to use the patents taken out by Sir Arthur Duckham or his firm relating to furnaces used in the barium or similar processes, in return for a share interest in the Syndicate.

TRADE NOTES.

BRITISH.

Fiji in 1919.—The chief products of Fiji are sugar, copra, and bananas. Although the sugar industry was suffering from a lack of labour, due to the disorganisation of Indian immigration, the amount of sugar shipped was 64,348 tons, or 1278 t. more than in 1918. Additional areas of coconut trees are coming into bearing, and the export of copra will probably increase steadily; exports in 1918 and 1919 were 19,318 t. and 27,311 t., respectively. The increased export of rubber from 36¼ t. in 1918 to 69 t. in 1919 was due to some extent to shipments held over from the previous year; the rubber trees continue to give satisfactory results, large areas are available for cultivation at reasonable rentals, and the prospects of the industry are favourable.—(*Col. Rep.—Ann., No.* 1047, *Nov.*, 1920.)

Gambia in 1919.—In the colony of Gambia, which covers 4132 sq. miles, exist many deposits of iron ore, ochre, and china clay, but none of these is mined. The iron ore is situated most favourably for direct loading into ships, but is of poor quality. The staple industry is farming, the chief crop being groundnuts, in which there is a considerable export trade. As an area of 640,000 acres of suitable soil is available for this crop, there is scope for considerable expansion. The collection and export of wild rubber have practically ceased. Small amounts of cotton are grown, but the further development of this and of other commercial crops is severely limited by the scarcity of rain. The exports, valued at £1,553,521, included 70,270 tons of groundnuts and 671 t. of palm kernels; gum and wax have practically disappeared from the export list. Of the import trade, valued at £1,250,320, the United Kingdom supplied 57 per cent., and the United States 19 per cent. (4 per cent. in 1915).—(*Col. Rep.–Ann., No.* 1053, *Dec.*, 1920.)

FOREIGN.

Trade of the Belgian Congo.—The Belgian Congo has developed rapidly since it was opened to world trade, the mining industry shows increased returns every year, and agriculture is making good progress. Coffee and rice are now staple exports; cotton growing is promising well, the 1920 crop being estimated at 982 tons. The export trade in 1917, valued at £7,164,022, showed an increase of over 250 per cent. as compared with 1913, and comprised 3700 long tons of rubber, 38,487 t. of palm oil, and considerable quantities of palm-nuts, cocoa, copal, ivory, coffee, timber, and various minerals. The imports, valued at £2,767,239, were derived chiefly from the United Kingdom, South Africa and Rhodesia, followed by the United States and France, the share of Belgium being small owing to export restriction. Among the imports were:—Cement, 2699 t.; petroleum, gasoline, etc., 2696 t.; colours, dyes, and varnish, 240 t.; and soap, 584 t. —(*U.S. Com. Rep., Nov.* 4, 1920.)

Portuguese Trade in 1919.—Although the export trade in 1919 increased but slightly, the value of the imports more than doubled, owing to diminished production, the introduction of the 8-hour day, and the need for replenishing stocks. Business, generally, was prosperous, coal again became available, and the cork industry had a good season.

The imports, valued at £38,600,500 (escudo = 3s. 4d. at par), included:—Cement, 12,155 metric tons; sodium borate, 44 t.; sodium carbonate, 1289 t.; sodium sulphate, 280 t.; caustic alkali, 2423 t.; carbonate of calcium, 1233 t.; chlorate of calcium, 1038 t.; nitrate of potash, 142 t.; nitrate of soda, 218 t.; quinine salts, 70 t.; copper sulphate, 2043 t.; other chemicals and drugs, 4844 t.; coal, coke, etc., 609,363 t.; dyes and colours, 851 t.; dyeing extracts, 947 t.; dyewoods, 165 t.; fertilisers, 23,292 t.; oils and fats, animal, 1272 t.; palm oil, 1532 t.; other oils, 322 t.; perfumery, 74 t.; and sulphur, 6305 t. The greater part of the chemical imports is supplied by England.

Among the exports, the par value of which was £18,425,666, were:—Argols, 11,666 metric tons; chemical products, 1526 t.; cork and cork products, 71,223 t.; hides, 1612 t.; cod oil, 524 t.; mineral oil, 569 t.; olive oil, 720,360 litres; copper ore, 18,403 t.; iron ore, 7375; wolfram, 770 t.; other ores, 1101 t.; paper pulp, 858 t.; rosin, 1661 t.; turpentine, 370 t.; wax, raw, 112 t.; vinegar, 320,610 litres; glassware, 365 t.; and soap, 189 t.—(*U.S. Com. Rep., Nov.* 3, 1920.)

GOVERNMENT ORDERS AND NOTICES.

Prohibited Exports.—The following have been removed from lists "A" and "B" of prohibited exports as from February 1:—(1) Coal tar, all products and derivatives thereof, whether actually so obtained or so derived from other sources (including all mixtures and preparations containing such products and derivatives), suitable for use in the manufacture of dyes or explosives; (2) dyes and dyestuffs manufactured from coal-tar products and articles containing such dyes and dyestuffs; and (3) indigo, synthetic.

Yeast was removed from the same lists on January 13.

Decontrol of Coal.—The Directions of the Board of Trade, dated August 25, 1920, regarding pithead prices of coal, are to be cancelled as from March 1 next, as there is now no danger of shortage within the country, and the export price has approached the home price so closely that there is no longer any reason for restricting prices. Further, the directions for the supply of specified districts or consumers, will cease to have effect from the same date, and inland consumers will then be free to purchase from any source. The position as to the supply of coal for foreign bunkers and export remains as published in the *Journal of the Board of Trade* for December 28, 1920, and January 10, 1921.

Fire Prevention.—A Royal Commission has been appointed to inquire into the existing provision for the avoidance and extinction of fires.

Miners' Lamps Committee.—The Secretary for Mines has reappointed, with extended terms of reference, the Miners' Lamps Committee which was appointed by the Home Secretary in May, 1919. The Committee has to report upon possible improvements in the safety and illuminating power of miners' lamps, testing methods, maintenance of the lamps, use in mines which show no indication of inflammable noxious gases, etc. Mr. W. Walker, of the Mines Department, is chairman, and Prof. R. V. Wheeler is a member of the Committee.

REVIEWS.

Nucleic Acids: Their Chemical Properties and Physiological Conduct. *By* Walter Jones. *Second edition. Pp.* viii. + 150. (*London: Longmans, Green and Co.* 1920.) *Price* 9s. *net.*

As the science of biochemistry advances the problem of the nature of the substances most intimately connected with the living cell—which constitute, as it were, the chemical basis of life—is being gradually unravelled and the substances themselves isolated and relegated to their proper position in chemical classification. Within comparatively recent years the sugars, the purines, the proteins, and the lipins have yielded many, though by no means all, of their secrets to the investigator, and some beginning has been made in the study of their functions in the living organism. In the present work an account is given of the elucidation of the chemical nature of another group of substances of great physiological interest—the nucleic acids. The fundamental importance of the nucleus in all the physiological relations of the cell has long been recognised by biologists and renders the story of the discovery of the chemical nature of the nuclear constituents, as told in the first half of Prof. Jones's book, one of intense interest and fascination. The nucleic acids occur in the cell nuclei combined either with proteins, as *α-nucleoproteins*, or with the much simpler protamines, in which form they are present, for example, in the spermatozoa of fish. The α-nucleoproteins consist most probably of various salts of protein with nucleic acid, in which the protein is in excess. When they are digested with pepsin part of the protein is digested away, leaving a mixture of more acid salts, indefinitely called *nuclein*. To use the term introduced by Kossel, the nucleic acids form the prosthetic group of the α-nucleoproteins and nucleins.

Many chemists have contributed to the discovery of the constitution of the nucleic acids, prominent among whom are Kossel, Levene, and Jones, the author of the present work. So far as is known only two nucleic acids exist: that prepared from the cells of animals, generally known as thymus nucleic acid; and that obtained from vegetable cells, usually termed yeast nucleic acid. These two agree in their general structure but differ in the nature of their components and to some extent in their behaviour towards reagents. Yeast nucleic acid, the better known of the two, is resolved by mild alkaline hydrolysis into four groups, known as *nucleotides*, each of which is a compound of phosphoric acid, *d*-ribose and a base, probably combined in that order. Two of these bases are purines, guanine and adenine; the other two pyrimidines, cytosine and uracil. These nucleotides are themselves decomposed by further hydrolysis with loss of phosphoric acid and formation of *nucleosides*, each composed of *d*-ribose and the corresponding base:—

	Neucleotides.	*Nucleosides.*
Yeast nucleic acid →	Guanine nucleotide	→Guanosine
	Adenine ,,	→Adenosine
	Cytosine ,,	→Cytidine
	Uracil ,,	→Uridine

The exact mode of combination of the various components within the nucleotides and of the nucleotides with each other is not yet definitely settled.

Thymus nucleic acid is probably constituted after a similar plan, but the sugar group is a hexose, and the four bases are guanine, adenine, cytosine, and thymine.

The second part of the book is devoted to the no less fascinating story of the physiological conduct of the nucleic acids, which affords an admirable example of the remarkable complexity of chemical changes in the living organism as well as of the extraordinarily specific adaptation of its enzymes to the materials upon which they have to exert their action. Briefly put, nucleic acid is first decomposed into its constituent nucleotides by means of a *nucleinase*, present in the intestinal juice. The nucleotides thus liberated may undergo decomposition in either of two ways. First, by the action of a *phospho-nuclease*, they may yield phosphoric acid and the corresponding nucleoside. This is the only change observed with the two pyrimidine nucleotides, and the fate of the resulting pyrimidine nucleosides is not fully understood. The purine nucleotides, however, may also be acted on by a *purine-nuclease*, yielding a purine and a carbohydrate phosphoric ester. The purine nucleosides may also be directly hydrolysed, by a *nucleosidase*, to purine and carbohydrate. Here, however, a further complication arises, for the purine bases themselves and the purine nucleosides may be deaminised (by specific enzyme action), guanine yielding xanthine, and adenine, hypoxanthine, whilst the two nucleosides undergo a similar change, forming new nucleosides, which on hydrolysis (again by enzyme action) yield xanthine and hypoxanthine. Finally, oxidising enzymes come into play, and the hypoxanthine passes first into xanthine and then into uric acid. Here in man and the higher apes the process stops and the uric acid is excreted, or lurks in the system to cause those ills which are the penalty of our evolutionary superiority. In the lower mammals, including the monkey, the uric acid is almost completely oxidised to allantoin, which is excreted.

To the biochemist this book cannot fail to be of profound interest, alike for the importance of the matter and the lucidity of the exposition. Appendices concerning practical methods and a bibliography of over five hundred papers add to its usefulness.

A. Harden.

Die Zwischenprodukte der Teerfarbenfabrikation. *By* Otto Lange. *Pp.* xxiv. + 645. (*Leipzig: Otto Spamer.* 1920.) *Prices:—Unbound, Germany,* 135 *marks plus* 40% *; England and Colonies,* 80*s.*

Closely bound up with the vitally important problem of developing our industry in fine chemicals, including the coal-tar intermediates, is the question of the provision of a technical literature of an informative character. Although the production of such treatises is more prevalent now than formerly in this country, English-speaking chemists are still largely dependent on German text-books for the detailed information which is essential to a working specialist in any of the main branches of chemical technology.

The appearance of the volume under review is one of many evident signs that this hegemony in chemical literature will not be easily surrendered, for whatever developments the future may bring, it is an indisputable fact that the published records of progress achieved in coal-tar chemistry during the past two or three decades are to be found largely in German patent specifications.

The author introduces his subject by laying stress on the circumstances that the coal-tar intermediates constitute the basis of the synthetic colour industry, and the task he has set himself is to present within moderate compass, in tabular form, an epitome of this very large group of chemical substances. The dimensions of the work may be gauged by noting that this tabulation contains 3637 entries; but these represent a far greater number of compounds, for in numerous instances the entry is generic and contains references to many chemical entities. The treatise is in the first instance divided into four principal sections under the headings of benzene, naphthalene, anthracene, and phenanthrene, and in each of these sections the derivatives of the parent hydrocarbon are arranged in increasing order of complexity. The introduction and summary of contents furnish an explanation of the system of arrangement whereby it is easy to find the reference to any desired intermediate. Each reference contains a characteristic number by means of which the intermediate or group of intermediates can be located on looking up the comprehensive index. The patent is cited in which the given intermediate was first described, and this quotation is followed by a concise summary of the method of preparation.

In the vast majority of cases references are given only to German patents, but occasionally English, French, and American specifications are quoted, but only as subsidiary citations. In many instances this information is supplemented by references to German scientific journals. Providing that the reader has access to the principal German patents on coal-tar intermediates, such as those reproduced in Friedländer's comprehensive treatises on the progress of the coal-tar industry, then the problem of tracking down any particular intermediate will be greatly facilitated. From the number of entries it is obvious that a very large number of intermediates are tabulated, but at the same time many substances of purely scientific interest are omitted, since these can be found by reference to the lexicons of Richter or Stelzner. Considerable space is saved by omitting all names of authors or patentees. On the other hand, the parts by weight of the reagents, the physical constants (melting and boiling points) of the products, and other experimental details are indicated whenever these are likely to be of practical utility.

Cross references are furnished by the addition of lists of the German provisional and complete specifications (Anmeldungen and D.-R.P.P.), so that when a patent number is known the compound or compounds described in the specification can be identified.

The text is remarkably free from typographical errors and other inaccuracies, and the entire treatise is a simple guide to the more detailed information scattered through German patent literature.

G. T. Morgan.

Benzol: Its Recovery, Rectification, and Uses. *By* S. E. Whitehead. *With an introductory note by the* Rt. Hon. Lord Moulton. *Pp.* xiv.+209. (*London: Benn Bros., Ltd.* 1920.) *Price* 12*s* 6*d net.*

Although the recovery of benzene and its homologues from the coal gas produced in coke ovens has been practised on the large scale for many years, the literature on the subject is very scattered and incomplete. The demand arising out of the war for the maximum production of benzene and toluene as the main raw material for high explosives, rendered necessary the equipment not only of all coke-oven installations with "benzol" plant, but also, as far as practicable, the adoption of the process in gas works; and in carrying out this work the want of book dealing with the subject was seriously felt. This want still continues in spite of the decreased requirements for explosives, as the combined demand for these hydrocarbons in the organic chemical industry and as motor spirit is far in excess of the supply.

Mr. Whitehead's book is designed to fill the gap and to incorporate the results of the author's experience on the technical staff of the Department of Explosives Supply during the war, with a very large number of installations of "benzol" plant, varying from fully equipped large-scale plants to small emergency plants often constructed largely from scrap material. The result is one on which both author and publishers may be congratulated, and the book will be a very valuable one for all engaged in the technical control of the process. A clear and concise account is given of the theoretical principles involved in the process of the recovery of the vapours from the gas by means of solvents, so far as these have been elucidated; in addition, some account is given of the principles of fractional distillation, etc., involved in the further refining of the "crude benzol" into commercial products, but the attempt to compress the treatment of this last very complex subject into a couple of pages is less successful. A full description of all the different forms of plant used for the various processes is, of course, impossible in a book of about 200 pages, but the selection made of typical apparatus is a good one, and these are clearly described with the aid of good diagrams, which are not, as so often happens, rendered obscure by the introduction of much unnecessary detail. The chapters relating to the minor details of construction and to the operation and control of plant are excellent and make it very clear, even to those who have otherwise no knowledge of the fact, that the author has been right in the midst of the various troubles and difficulties which occur in the starting and in the regular running of the plants.

The book is clearly printed on good paper and is remarkably free from typographical errors; it may be heartily commended to those interested, whether in gas works, for whom it is more especially written, or in coke-oven installations. H. G. Colman.

OBITUARY.

J. C. CAIN.

British chemists will deplore the loss of a highly valued and warmly esteemed colleague by the death of John Cannell Cain, which took place suddenly on January 31, in his fiftieth year. Dr. Cain was the eldest son of the Rev. Thomas Cain, and after graduating at Owens College in 1892 proceeded to Tübingen, whence he passed to Heidelberg a year later. His first post was with Messrs. Levinstein, to whom he went in 1895, and the six years' experience there gained was a foundation to the wide knowledge of dyestuff-manufacture which ultimately distinguished him. After being for three years in charge of chemical and physical instruction at the Municipal Technical School, Bury, he became manager and head chemist to Messrs. Brooke, Simpson and Spiller for the remaining period of that firm's existence, 1904—6; in the latter year he was appointed editor of the publications of the Chemical Society.

Throughout his long and successful tenure of this office he maintained association with the branch of chemical industry which had first claimed his interest, and this fidelity to the chemistry of coal-tar products bore valuable fruit during the war. The first duty entrusted to him by Lord Moulton, as Director of Explosives, was to report on the convertibility of chemical factories to the purpose of explosives manufacture and, in the cases of such conversion being made, periodically to report on the progress achieved. His knowledge of TNT manufacture was further utilised by placing him in charge of H.M. Factory, Hackney Wick, and as the months passed on, and the organisation of explosives production improved, he was transferred to British Dyes, Ltd., becoming a member of the Technical Committee at its foundation; in 1916 he was placed in charge of the plant for intermediates-manufacture then arising on the Dalton site at Huddersfield. His energy and enthusiasm were bounded only by his physical strength, which he overtaxed in the zealous devotion to duty. Nevertheless, his contribution to this particular branch of the national effort in those harassing years was a very substantial one.

Thus, on bringing into review his most active life, it will be recognised that Dr. Cain presented an unusual combination of qualities. Conspicuously a practical chemist, he loved the laboratory and the factory, but interwoven with craftsmanship was a literary strain which he turned to remarkable account, not only in the sound and conscientious work which characterised his editorship, but also in producing the admirable treatises on colour chemistry by which his name is extensively known. His recollection of chemical data was notably exact, and his willingness, his cheerful capacity for work, amazing. Those whose privilege it was to receive his loyal co-operation are deeply conscious that a generous-hearted enthusiast has left them.

M. O. Forster.

PUBLICATIONS RECEIVED.

A Text-Book of Inorganic Chemistry for University Students. *By* J. R. Partington. *Pp.* 1062. (*London: Macmillan and Co., Ltd.* 1921.) *Price* 25*s.*

An Introduction to the Chemistry of Plant Products. Vol. I. *By* P. Haas *and* T. G. Hill. *Third edition. Pp.* 414. (*London: Longmans, Green and Co.* 1921.) *Price* 16*s.*

A Dictionary of Applied Chemistry. Vol. I. A—Calcium. *By* Sir E. Thorpe, *assisted by eminent contributors. Revised and enlarged edition. Pp.* 752. (*London: Longmans, Green and Co.* 1921.) *Price* 60*s.*

Bibliotheca Chemico-Mathematica. *Catalogue of works on exact and applied science. Vol. I., pp.* 428. *Vol. II., pp.* 429. (*London: Henry Sotheran and Co.* 1921.) *Price* 63*s.*

Introduction to Qualitative Chemical Analysis. *By* Th. W. Fresenius. *Seventeenth edition, translated by* C. A. Mitchell. *Pp.* 954. (*London: J. and A. Churchill.* 1921.) *Price* 36*s.*

Water Purification Plants and their Operation. *By* M. F. Stein. *Second edition. Pp.* 270. (*New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.* 1919.) *Price* 16*s.* 6*d.*

Rubber, Resins, Paints, and Varnishes. *By* R. S. Morrell *and* A. de Waele. *Industrial Chemistry Series, edited by* S. Rideal. *Pp.* 236. (*London: Baillière, Tindall and Cox.* 1921.) *Price* 12*s.* 6*d.*

Modern Manufacture of Chemical Manures. *Pp.* 85. (*London: Sturtevant Engineering Co., Ltd.* 1920.) *Price* 12*s.* 6*d.*

Special Reports on the Mineral Resources of Great Britain. Vol. XIV.—Refractory Materials: Fireclays. *Memoirs of the Geological Survey. Pp.* 243. (*London: H.M. Stationery Office.* 1920.) *Price* 8*s.*

The Determination of the Carbon Dioxide in Coal. *By* F. S. Sinnatt *and* W. Harrison. *Bulletin 7. Lancashire and Cheshire Coal Research Association.* 1920. *Price* 1*s.*

Indian Tanstuffs. *By* J. A. Pilorim. *Government of India, Board of Industries and Munitions.* (*Calcutta: Superintendent Government Printing, India.* 1920.) *Price* 6 *annas.*

The Society as a body is not responsible for statements and opinions appearing in the *Journal.*

SOCIETY OF CHEMICAL INDUSTRY.

ARRANGEMENTS FOR THE ANNUAL MEETING, 1921.

As already intimated in these columns, the Annual Meeting will be held this year in Montreal from Monday, August 29, to Wednesday, August 31, and from Montreal the visitors will travel to Grand Mere, Shawinigan Falls, Ottawa, Toronto, Niagara, and New York (*cf.* J., Dec. 15, 1920, 407 R). Owing to the kindness of friends on both sides of the water, it is now possible to give some detailed information concerning the steamship services, arrangements in Canada and the United States, and a rough estimate of the cost of the trip. The voyage from Liverpool to Montreal takes approximately ten days, but it may take a day or two longer, and visitors are recommended to arrive in Montreal not later than Saturday, August 27. The following list of sailings and approximate fares has been compiled from information supplied by the steamship companies mentioned:—

Sailings from Liverpool to Montreal.

Line.	Boat.	Date of sailing.	Minimum single fare
White Star	Megantic	Sat., Aug. 13	1st class, £51 5s.
C.P.O.S.	Melita	Fri., Aug. 12	One class, £30

Sailings to New York.

White Star	Cedric	Wed., Aug. 17 (Liverpool)	1st class, £51 5s.
White Star	Adriatic	Wed., Aug. 17 (Southampton)	1st class, £55
Cunard	Aquitania	Sat., Aug. 13 (Southampton)	Saloon, £62 10s. 2nd class, £33 15s.
Cunard	Caronia	Sat., Aug. 13 (Liverpool)	Saloon, £51 5s. 2nd class, £31 5s.

Sailing from Montreal to Liverpool.

White Star	Megantic	Sat., Sept. 24 (approx.)	1st class, £51 5s.

Sailings from New York to Liverpool.

White Star	Celtic	Sat., Sept. 24	1st class, £51 5s.
Cunard	Caronia	Sat., Sept. 24	Saloon, £51 5s.

Sailings from New York to Southampton.

White Star	Olympic	Wed., Sept. 14	1st class, £62 10s.
White Star	Kroonland	Fri., Sept. 16	1st class, £48 15s.
White Star	Adriatic	Wed., Sept. 21	1st class, £55
White Star	Zeeland	Fri., Sept. 23	1st class, £48 15s.
Cunard	Aquitania	Tues., Sept. 13	Saloon, £62 10s.
Cunard	Imperator	Thurs., Sept. 22	Saloon, £62 10s.

The above dates of sailing are subject to alteration.

The President will sail by the s.s. "Megantic" on Saturday, August 13, and it is hoped that as many members (and their friends) as possible will accompany him. Ladies are invited to accompany the party.

Every member who proposes to be present at the Annual Meeting, or to take part in any of the proceedings in Canada or the United States is asked to communicate his intention without delay to the General Secretary, *but all travellers must book their own passages in both directions* and obtain any further information at the Liverpool offices of the following companies:—

White Star Line.—30, James Street, Liverpool.

Canadian Pacific Ocean Services.—H. Taylor, Pierhead, Liverpool.

Cunard.—Cunard Building, Liverpool.

The above companies have notified that passages should be booked at once. When applying for tickets, members and others should state that they belong to the "S.C.I." party. No reduction is made on return tickets.

With regard to hotel accommodation, we are informed that the cost of a bedroom per night is, as a rule, $4—6, say 20s.—30s., and that the sum of £3 per day, inclusive of the above, should suffice to cover ordinary living expenses. In New York, however, it should be easily possible to live on a smaller sum. In a recent letter, Mr. S. R. Church, chairman of the American Section, states that through the good offices of Prof. R. H. McKee, the authorities of Columbia University have offered rooms in the dormitory buildings of the University at very low rates, and that preference will be given to visitors from Great Britain. The exact charge has not yet been fixed, but in all probability it will not exceed $1 per night for a single room; meals will be served at the Faculty Club for about 75 cents per meal and at a lower rate in the students' common room. The cost of railway travel, continues Mr. Church, from Montreal to Toronto, the Falls, and New York will not be a very large item of expense, as the total distance does not exceed 900 miles, and the tariff, including Pullman accommodation, averages about 4 or 4·5 cents per mile.

In view of the diversity of personal tastes and of the difficulty of forecasting prices some 6—7 months ahead, it is not possible to state precisely what sum would cover the whole cost of the trip, but from all the information available at the time of writing it appears that for those who would eschew undue luxury it should lie between £150 and £200, first-class travel and hotel accommodation being assumed. The expenses of those who travel by one of the cheaper boats and who take advantage of the generosity offered by the authorities of Columbia University would probably not exceed £150.

The Council wishes it to be known that it attaches very great importance to this visit both from the standpoint of the future development of the Society and from that of the national welfare. The value, both actual and prospective, of Canada and of Canadian chemical industry to the motherland, and to the Empire, must be apparent to all whose interests extend beyond the immediate objects of sense-experience. By taking part in this visit to our kith and kin in Canada and the United States, members (and their friends) will not only be able to obtain first-hand knowledge of important chemical industries, learn something of new and improved methods of work and organisation, and exchange views and information mutually advantageous, but they will also be afforded opportunities of strengthening ties of friendship that already exist, so paving the way to better understanding, greater appreciation, and more effective co-operation between the Old World and the New.

REPORTS OF THE PROGRESS OF APPLIED CHEMISTRY.

The fifth volume of these Reports, covering the year 1920, is now in the press, and will be ready shortly. As last year, they relate to the whole range of subjects dealt with in the Journal.

Those who have read the preceding volumes will know that the Reports occupy a niche in the literature of chemical technology which is not filled by any other publication. They represent the principal features of the year's literature and progress summarised by experts, who have separated the weak from the strong, the mediocre from the suggestive, and have given summaries of the progress in the various branches which should be indispensable.

The literature of chemical technology is nowadays so extensive and so varied that it is becoming increasingly difficult even for the specialist to keep in complete touch with the portion dealing with his own subject, quite apart from other subjects in which he may be interested, so that he has perforce to neglect almost entirely the remaining branches of chemical industry. The abstracts in the Journal form a fund of information in condensed form, but they are naturally of a somewhat disjointed character, and it is not easy for the reader to gather from them a connected account of what has been or is being done in branches of industry other than his own. For this reason the Annual Reports should prove an indispensable addition to the library of every chemist and manufacturer, and it is hoped that those who have realised their value will help in making their character more widely known among those who have not.

In the space available here it is impossible to give a complete account of the contents of the volume now in the press, but a few notes on some of the items dealt with may be of interest.

In the section on "Plant and Machinery," Dr. W. B. Davidson gives an account of the new electrostatic dust separator erected at Skinningrove. The subject of lubrication is also fully dealt with both in this section and in that on "Mineral Oils" (*cf. i.*). He also deals with the ever-important question of efficiency of combustion and fuel conservation, subjects which are also treated from their respective standpoints by Prof. J. W. Cobb and Mr. H. J. Hodsman in the section on "Fuel" and by Dr. G. Weyman in the section on "Gas and Carbonisation." In these two sections also the Gas Regulation Act receives due attention, whilst the reports indicate distinct, though slow progress in the elucidation of the chemical nature of coal and the mechanism of combustion, and the improvement of carbonisation. The work of the Nitrogen Products Committee, as revealed in its report published early last year, is alluded to in these and in several other sections of the volume, where it touches on the heavy chemical, electrochemical fertiliser and other industries. Dr. A. E. Dunstan, in the section on "Mineral Oils," discusses the conservation of oil resources and the best methods of utilising available supplies; he also deals, *inter alia*, with the conversion of paraffins into fatty acids (a topic also discussed by Mr. Allan), the manufacture of helium, and the progress of "colloidal" fuel.

In the section on "Colouring Matters and Dyes," by Mr. F. M. Rowe, there is an interesting account of the commercial development of the industry; in regard to technical progress perhaps the most interesting work of the year, from the standpoint of the general reader, is that dealing with photosensitising dyes—a subject which is naturally also considered fully in the photographic section. Mr. S. S. Napper records a notable improvement in the character of the work on "Fibres, Textiles, Cellulose, and Paper," especially as regards researches on the chemistry and constitution of cellulose and its derivatives, and on the chemistry and analysis of woods. In the section on "Bleaching, Dyeing, Printing, and Finishing," by Mr. B. Leech, considerable progress is recorded in such matters as the scouring of textiles and the production of Aniline Black.

The most important work of the year in the domain of "Acids, Alkalis, and Salts," dealt with by Dr. T. Ewan, relates to the synthesis of ammonia (with especial reference to the Claude process), the production of nitric acid and of cyanides.

Prof. W. E. S Turner has much useful work on "Glass" to put on record, especially in regard to optical glass and the effect of varying composition on the properties of glass; it is gratifying to note that much of this work was done in this country. The same author deals with "Refractories," and in this and the section on "Ceramics," by Mr. W. C. Hancock, the predominance of the scientific work done in this country and in America is apparent.

Prof. J. H. Andrew, dealing with "Iron and Steel," remarks that these industries are rapidly becoming more scientific in character. Valuable work is recorded in regard to blast-furnace practice, special steels, etc., particular note being made of the Report of the Steel Research Committee on the subject of wrought automobile steels. Prof. C. H. Desch also has useful progress to record in "Metallurgy of the Non-Ferrous Metals"; in this report the flotation process and the metallurgy of zinc and tungsten occupy important places, and full consideration is given to the question of brasses and the theory of corrosion. Reporting on the "Electrochemical and Allied Industries," Mr. D. F. Campbell notes the depressing effects on these industries of the prevailing industrial and financial conditions; much of this section is devoted to iron, the electrical production of steel, and ferro-alloys, electrolytic zinc, and carbon electrodes.

Mr. John Allan comments on the lack of work on the general chemistry of "Oils, Fats, and Waxes." In addition to dealing with the oxidation of paraffins, he also has considerable progress to record on the chemistry of marine animal oils and drying oils, and on the important subject of fat-hardening. Drying oils are also dealt with by Mr. A. de Waele in the section on "Paints, Pigments, Varnishes, and Resins"; in these industries a large volume of work is evident, especially on the examination of pigments and varnish products. Dr. H. P. Stevens records considerable progress in work on the preparation of raw rubber (particularly that carried out in Java) and also on accelerators of vulcanisation, much of this latter being of British origin; the Peachey process of cold vulcanisation is also dealt with. In the section on "Leather and Glue" Mr. F. C. Thompson gives especial prominence to the work on analysis of tanning materials (with special reference to the question of "true tanning value"), the theory of tanning, and the chemistry of hide and gelatin—subjects on which much useful research has been published.

Dealing with "Soils and Fertilisers," Dr. E. J. Russell gives an interesting summary on the nitrogenous fertilisers and deals adequately with other sources of plant food; he also supplies a useful account of recent work on the determination of hydrogen-ion concentration and its significance in agriculture. Mr. J. P. Ogilvie, in the section on "Sugars, Starches, and Gums," traces the progress of the raw material (both cane and beet) through the various processes of sugar making, and deals with the improvements in extraction, clarification (including the use of decolorising carbons), and boiling to grain; the work carried out by the U.S. Bureau of Standards on the determination of sucrose by double polarisation is fully described. Messrs. A. Tait and L. Fletcher contribute the section on "Fermentation Industries," and have much work to record, including a number of papers on the chemistry of enzymes and the fermentation process, yeast, and power alcohol; the work on fermentation acetone is also noted and also that on vitamins in so far as it applies to the industries in question. This latter topic is fully discussed by Dr. H. W. Bywaters in the section on "Foods," and considerable progress in this direction is recorded; much useful work on bread and flour is also noted, and due consideration is given to the report of the Food Investigation Board. Dr. H. T. Calvert deals with "Sanitation and Water Purification," and gives an account of the steps being taken to prevent rivers pollution and the progress towards an understanding of the "activated sludge" process of sewage treatment.

In the section on "Fine Chemicals, Medicinal Substances, and Essential Oils" Dr. T. A. Henry gives instances of the great fall in prices of these products during the last few years. Among the topics with which he deals are the chemistry of cinchona and opium alkaloids, local anæsthetics, essential oils, and organic compounds of metals (arsenic, antimony, mercury, silver). Mr. R. E. Crowther contributes the section on "Photographic Materials and Processes," and has considerable progress to record in work on the chemistry of development processes and the preparation of photographic emulsions sensitive to light of all colours; the allied subject of photo-sensitising dyes naturally finds a place here, and some important work on sensitometry is also described.

Mr. W. R. Rintoul has a large mass of work to report in "Explosives," both as regards high explosives for military and for civil purposes, and on the initiation of explosions. Much of the work carried out during the war on nitroglycerin and nitrocellulose has now become available and is duly noted. In conclusion, Mr. C. A. Mitchell has made a judicious selection of the more important literature on "Analytical Chemistry" as applied to technical work in those subjects in the reports of which it has not been dealt with.

The above brief notes may serve to give some idea of the vast amount of work covered by the reports. It will also indicate that there is a certain amount of duplication in the work discussed in the various sections. This is a desirable feature, since it presents important subjects from quite different standpoints—often from those of producer and user respectively—and so enables the reader to gain a more balanced view of the subject.

FEBRUARY MEETING OF COUNCIL.

The monthly meeting of the Council was held on February 11, Sir Wm. J. Pope presiding. Among other matters considered the following may be mentioned:—

It was reported that Monsieur Paul Kestner's paper which is to be read at a joint meeting of this Society and the Institution of Mechanical Engineers on March 4 will be printed in the *Proceedings* of the Institution, and that arrangements had been made for the Society to publish in the Journal as much of the paper and discussion as it considers desirable A supply of advance proofs of the paper will be available for distribution to any members of the Society who may wish to have a copy.

The Council agreed to make a grant of £100, as was done last year, to the Chemical Society towards the expenses of its Library scheme.

Owing to the considerations that a re-transfer of the Society's investments would entail expense, and that a trustee would be ineligible for election to the Council, it was resolved that the investments forming the Messel Fund should be held directly by the Society and not by trustees.

It was intimated that no essay had been received in competition for the Cross and Bevan Prize and the Latham Fellowship, and an alternative scheme was submitted by Mr. C. F. Cross, which was approved by the Council. Particulars of this will be published in due course.

Information was furnished regarding the sailings of steamships to Montreal in time for the Annual Meeting in the Autumn, full particulars of which appear on page 59 R of this issue.

Sixty-eight new members were elected, of whom 52 are home members, 2 colonial, 3 Indian, 9 in the United States, and 2 in other foreign countries.

Sir William Pearce, M.P., was elected the Society's representative on the Governing Board of the Imperial College of Science and Technology, in succession to Dr. C. C. Carpenter, resigned.

The Secretary laid on the table the original Register of the Society, which had been discovered during some alterations in the premises of the United Alkali Co., Ltd., Widnes.

NEWS FROM THE SECTIONS.

BIRMINGHAM.

A meeting was held in the University Buildings on January 27, with Dr. H. W. Brownsdon in the chair. Messrs. E. C. Rossiter and P. H. Sanders presented a paper on "The Preparation of Zirconia from Brazilian Ore and a New Method of Determination," in which they described a process for preparing zirconia of 98—99 per cent. purity by fusing the ore with its own weight of caustic soda at a maximum temperature of 600° C., and then proceeding as follows:—The melt is lixiviated with water, washed, and the residue evaporated to dryness with hydrochloric acid. It is then extracted with water and filtered, when 80 per cent. of the zirconia is obtained in solution. The dilute solution is heated with sulphurous acid to reduce the iron salts, and then the addition of dilute sulphuric acid effects a quantitative precipitation of a basic zirconium sulphate having the composition $5ZrO_2.2SO_3.xH_2O$. This is washed by decantation, filtered, dried, and converted into zirconia by ignition. The conditions under which the precipitation of the basic zirconium sulphate is quantitative were given.

On February 10, Capt. B. J. Eaton gave a lecture on "Plantation Para Rubber" to a joint meeting of the Section and the Birmingham University Chemical Society.

The lecturer opened with some statistical information, stating, *inter alia*, that of the 350,000 tons of Hevea rubber now produced annually, about one-half comes from British Malaya (where the planted area is about 1½ million acres), one-quarter from Ceylon, Southern India and Burma, and almost all the remainder from the Dutch East Indies; about 75 per cent. of the world's output is supplied by the British Empire. The production of fine hard Para rubber from the wild Hevea in South America remains stationary at about 30,000 t. per annum, but African and other wild rubbers have practically disappeared from the market. The rest of the lecture dealt with the collection and coagulation of the latex and with chemical problems connected with the preparation of the raw material and the influence of method of preparation and other factors upon the raw product during vulcanisation. At the present time acetic acid is almost exclusively used as coagulant, although, owing to its high cost, it was to some extent replaced by sulphuric acid during the war; but mineral acids are in general unsuitable owing to their influence on the raw rubber during vulcanisation. The use of alum for this purpose in Malaya has been prohibited by legislation. After describing the preparation of smoked and unsmoked sheet and of pale crêpe, and indicating how the mode of preparation influenced the speed of vulcanisation, Mr. Eaton described briefly the work which had been done in the laboratories of the F.M.S. Department of Agriculture, showing how the cause of this variation in speed had been elucidated and how it could be overcome. Finally, in referring to variability in tensile properties, he stated that there was evidence that inferior tensile strength was in some cases due to intrinsic differences in the raw product, *i.e.*, in the caoutchouc, not in the mode of preparation.

BRISTOL AND SOUTH WALES.

At an ordinary meeting held at University College, Cardiff, on February 4, Prof. C. M. Thompson presiding, a paper was read by Dr. R. W. Atkinson on "The Iron Ores of South Wales."

After referring briefly to the ironstones of the coal measures, the author proceeded to describe the chief occurrences of iron ore in South Wales. The so-called limonite deposit extends from Rudry to Bridgend and probably further, as there is evidence of the mineral as far west as Mumbles. The ore occurs between a dolomitic conglomerate and underlying carboniferous limestone; the angle of dip is 32° N., frequently following cracks and joints in the strata. Although ore was formerly raised in large quantities from Trecastle Mwyndy, Garth, and Llanharry, to-day the only mine working is that of Llanharry. Analyses show that the preponderating mineral is not limonite, but göthite ($Fe_2O_3.H_2O$), the observed ratio of Fe_2O_3 to H_2O being very nearly 1:1. Some of the ore very closely resembles the well-known Cumberland kidney-ore in appearance and is also found to be göthite. Regarding the origin of these deposits, the author expressed the view that the replacement followed the entrance of the iron from above and not from below, as has been thought by some. Experiment shows a marked difference in bulk between the freshly precipitated oxide and the mineral of lesser hydration.

NOTTINGHAM.

At a meeting held on February 16, Mr. J. H. Dunford presiding, Sir William Pope gave an address on the scientific aspects of colour photography (*cf.* J., 1920, 369 R), at the close of which Mr. H. D. Richmond described his early experiments on the same subject.

FATS AND FATTY ACIDS FROM HYDROCARBONS.

Synthetic fatty acids.—Methods for producing fatty acids may be broadly classified into two main groups, in the first of which the fatty acids are built up from hydrocarbons of low molecular weight, such as ethylene or acetylene, or are truly synthesised from hydrocarbons of high molecular weight by means of known reactions. In the second class a hydrocarbon of a higher molecular weight than that of the fatty acid required is submitted simultaneously to partial degradation and oxidation. In this class paraffin wax or high-boiling natural hydrocarbons are obviously available as raw materials.

Synthesis from compounds of low molecular weight.—It is not the writer's purpose to describe fully the various methods by which fatty acids have been built up from such substances as ethylene or acetylene. It will be sufficient to indicate the methods of Harries and Willstäter, who propose to synthesise glycerol, and by polymerisation and oxidation to convert it into such acids as oleic acid. When it is considered that ethylene or acetylene is to be converted into formaldehyde or ethyl alcohol, and glycerol obtained from the latter, it will be obvious that the number and complexity of the reactions involved are incompatible with technical and competitive production. The failure of the synthetic-alcohol process in Switzerland—by which calcium carbide was treated to produce acetylene, acetaldehyde produced from the latter by catalytic hydration in the presence of mercuric salts in acid solution, and ethyl alcohol obtained by the hydrogenation of the acetaldehyde in the presence of reduced nickel as catalyst—is distinctly significant in this connexion, for cheap electrical power for the manufacture of calcium carbide and for the production of electrolytic hydrogen, is available in Switzerland, and alcohol prices seem to have been sufficiently high of late to render the prospects of such a synthetic process more than usually favourable.

Further, by assuming an impossibility, namely, that all the complex reactions could be carried out at almost 100 per cent. efficiency, it is clear that, as all the carbon of the resulting fatty acid must come from the original ethylene or acetylene, a ton of fatty acid could not be produced from less than about a ton of hydrocarbon gas. The production of a ton of the comparatively cheap acetylene necessitates the usage of about four tons of 80 per cent. calcium carbide. Bearing this figure in mind, and making allowances for losses in processes, working expenses, chemicals, power and labour, it is scarcely necessary to elaborate any destructive criticism of processes which use the available low-molecular-weight compounds as starting material for the synthesis of fatty acids.

The Zelinsky Process.—The Zelinsky process, by which a paraffin hydrocarbon is chlorinated in the α-position, a magnesium-alkyl chloride made, carbon dioxide passed in, and the resulting compound acidified to liberate the fatty acid corresponding to the original paraffin, is extremely interesting theoretically, and represents as skilful a piece of work as any of the German synthetic processes. It fails absolutely when subjected to the test of practical applicability, although it is rumoured that the United Chemical Works of Charlottenburg carried it out successfully during the later years of the war. There are, however, several theoretical objections to this process, apart from the cost in metallic magnesium (about 10 per cent. of the weight of fatty acid produced being required) and the cost of chlorine for the original chlorination —the hydrochloric acid produced being used in the final acidification of the "Grignard" carbon-dioxide addition product. In the first place, a satisfactory and determinate chlorination of even an extremely carefully fractionated "cut" of petroleum is apparently impossible. It has been shown by Mabery (J. Amer. Chem. Soc., **28**, 165) that a monochloride having the chlorine atom in the α-position is extremely difficult to prepare.

Again, assuming that a suitable chlorine derivative or derivatives of one or more hydrocarbons of desirable molecular weight could be obtained, the formation of the magnesium-alkyl chloride is not easy. Anyone familiar with the Grignard reaction knows the difficulty of preparing magnesium-alkyl halides from halogen derivatives of hydrocarbons of even moderately high molecular weight. A suitable solvent has still to be discovered in which to carry out the reaction with compounds prepared from high-boiling hydrocarbons. Moreover, the magnesium-alkyl halides of high molecular weight do not react in the same simple direct way as those of lower molecular weight. There is always a tendency to react with the alkyl chloride, with the ultimate production of condensation products of complex hydrocarbons.

On the whole, therefore, it is exceedingly difficult to see how such a complex series of reactions can be carried out on a commercial scale. Zelinsky, it is true, states that satisfactory yields of an acid, $C_{10}H_{20}O_2$ were obtained when a hydrocarbon mixture boiling between 132° and 144° C. was used as starting material, but the results have not been substantiated on a technical scale, and yields would undoubtedly be still lower when higher hydrocarbons were employed with the intention of obtaining acids of the order of stearic and oleic.

There can be no doubt that the Zelinsky process is uneconomical for practical purposes at present.

The oxidation of hydrocarbons.—The higher hydrocarbons which occur in the natural petroleums and in the products of destructive distillation of coal, lignite, shale, etc., provide a very attractive and comparatively cheap starting material for the production of fatty acids by oxidation processes. Both paraffins and olefines have been utilised in the suggested processes, and in many instances a relatively expensive paraffin wax has been employed. It is clear, however, that a process, successful when the fairly simple mixture of hydrocarbons contained in paraffin wax is used as starting material, would not necessarily be applicable to the many varieties of natural petroleums, and this fact should be borne in mind when such apparently satisfactory results as are quoted by Grün (*cf. i.*) are being considered.

The Harries process, in which the high unsaturated hydrocarbons are treated with ozone, the resulting ozonides decomposed by steam into peroxides, and the latter transformed into alkali salts of the higher fatty acids by treatment with caustic alkali solutions, requires little consideration here, although large scale trials have been made. The constitution of natural hydrocarbons, or of those obtained by destructive distillation processes, is by no means clear, but we are sufficiently familiar with its general outlines to know that the formation of an ozonide mixture in appreciable quantity from such oils is scarcely possible. Indeed, Harries states that only 0·12 tons of fatty acids can be produced from the olefines contained in the oils resulting from the destructive distillation of 100 tons of lignite.

The power charges for the production of the necessary amount of ozone are far too high to enable a process dependent primarily upon ozone to be economically feasible when the end product is a fatty acid, and not a "fine" chemical. We may here contrast the production of vanillin from iso-eugenol by means of an oxidation process depending upon the use of ozone. In this case the value of the product allows of a relatively expensive oxidising agent being used, especially as much higher yields result than are obtained by the employment of such oxidising mixtures as potassium bichromate and sulphuric acid.

The direct oxidation of a hydrocarbon mixture, *e.g.*, paraffin wax or a petroleum distillate, by means of atmospheric oxygen offers an attractive solution of the problem of the production of fatty acids. Intense interest has been concentrated upon this question in Germany, and this has led to many superficial attempts to solve the problem by "hit or miss" experimentation. It is true that results have been quoted which appear to be satisfactory, and, within certain limits, the production of fatty acids seems to have been achieved. The names of Franck, Farien, Kelber, Fischer and Schneider, and Löffl come into mind in this connexion. But one general criticism is suggested here. The results are, as a whole, far too indeterminate, and give little feeling of scientific confidence. We have the so-called influences of this and that catalyst described. We have the effect of pressure and temperature upon the formation of fatty acids discussed, but little valid experimentation is given as backing. We have yields quoted which should assure the commercial success of the processes, and yet fatty acids are not being manufactured. Finally, most of the oxidation experiments were carried out with a high-class paraffin wax as starting material. The hydrocarbons of the latter, under the influence of temperature, pressure and catalyst and with the passage of a current of air, are pyrolytically decomposed and presumably oxidised at the double bond formed on the "splitting" or "cracking" of the hydrocarbons. Even in this case, as is to be expected, a large variety of acids is produced, and this from a fairly simple mixture of hydrocarbons. The difficulty of applying the reaction generally without extensive research upon the various natural oil mixtures is apparent.

Some of the more reliable results, however, indicate a very promising outlook for this process, since the raw materials are cheap, abundant, and available, and the working expenses not, *primâ facie*, excessive.

It is known, of course, that the D. Fanto works at Pardubitz have been manufacturing an oxidation product of paraffin wax for some time, and have been obtaining a mixture of fatty acids which are said to be technically useful. The Franck process, moreover, in which paraffin is oxidised under pressure and in the presence of a catalyst consisting of a resinate of vanadium, manganese, etc., claims to obtain a yield of 85 per cent. of fatty acids, and a net yield of 70—75 per cent. of higher acids suitable for soap-making, esterification to produce fats, and for other purposes.

The results of many researches which have been communicated to scientific societies, especially in Germany, have been exceedingly contradictory, agreeing in practically one thing only, namely, the excellence of the yield of valuable fatty acids.

It is perhaps significant, too, that when the less highly-refined mixture of hydrocarbons resulting from paraffin-wax pressing was employed in place of paraffin wax itself, much poorer yields were obtained in at least one instance.

It is clear from even a cursory examination of the available literature on the subject of the oxidation of hydrocarbons to fatty acids that a great deal of fundamental knowledge is lacking, and that comprehensive researches must be initiated if success is to be attained.

The work of Grün, Ulbrich and Wirth (Ber., 53, 1920, pp. 987—996) appears to afford a striking contrast in many respects to that of several other investigators. It is claimed that the divergent results quoted by different observers are due, in many cases, to the lack of sufficiently accurate analytical control. It is, moreover, preferable to effect a less complete transformation of the original hydrocarbon in order to obtain larger yields of the higher fatty acids. An almost complete conversion often leads to excessive breakdown of the hydrocarbon chain, one carbon atom after another being oxidised away, with the production of lower fatty acids, soluble in water, and technically not so valuable as those of higher molecular weight. It is pointed out that the oxidation can be effected not only with oxygen and air, but also with a gas mixture containing as little as 1 per cent. of oxygen; and under mild conditions of oxidation, and with this 1 per cent. oxygen mixture, only 5 per cent. of water-soluble fatty acids was obtained, whilst simultaneously 50 per cent. of higher, water-insoluble fatty acids was produced. Again, under otherwise suitable conditions, the presence of many so-called catalysts is superfluous—as Löffl has also pointed out—and sometimes actually harmful.

When pure oxygen is used, the reaction is frequently so vigorous as to cause explosions, due to the rapid decomposition of substances of a peroxide nature. In a "normal" oxidation only small quantities of these peroxide substances are produced, and are immediately decomposed with no untoward results.

These observers noticed for the first time the production of waxes, which result from the esterification of the higher fatty acids with the higher alcohols formed as intermediate products in the oxidation. The complex reaction product contains, in addition to saturated fatty acids, quantities of hydroxy acids, and of unsaturated fatty acids formed from the latter by dehydration. The unsaponifiable residue contains only a little unchanged hydrocarbon, and consists chiefly of alcohols and ketones. In addition to taking extensive precautions with regard to analytical control and to reproduction of results in "repeat" experiments carried out under similar conditions, these observers have studied the oxidation of a pure hydrocarbon, namely, pentatriacontane, which is surely a move in the right direction.

Problems awaiting solution.—It is essential that a complete survey of the chemistry of the higher paraffins and olefines be made. Very definite information as to the occurrence of particular hydrocarbons in different fractions of mineral oils is lacking, and must be obtained if we are successfully to oxidise them to fatty acids of definite composition and value. Methods of characterising the various mineral oils which are to serve as raw materials for this purpose must be available; and apparatus must be designed for obtaining any particular component or a definite mixture of components from natural oils on a practical scale.

With the chemistry of mineral oils established on a sound basis, it will be possible to turn with better prospects of success to the subject of the oxidation of a suitable fraction of a natural oil. More systematic atacks can then be made upon the problem of the influence of the various factors upon the oxidation, *e.g.*, the presence of a suitable catalyst, or of no catalyst at all, the presence of some alkaline agent to combine with and remove from the sphere of reaction the fatty acids produced, the effect of impurities, temperature, pressure, and so forth. Again, if known hydrocarbons can be isolated from mineral oils, experiments can be commenced upon the individual treatment required by the different classes of hydrocarbons. For instance, a hydrocarbon with about eighteen carbon atoms in its chain, but with an olefine linkage in the α-position, would possibly require different oxidation treatment from that applied to a similar hydrocarbon in which the double linkage was in the middle of the chain, and, of course, in the latter case widely different products would result.

The study of the chlorination products of the saturated hydrocarbons should be made in greater detail even than has been done by Mabery (*loc. cit.*), and with the extremely difficult question of α-chlorination settled, attention could be turned to the elimination of hydrochloric acid, and the formation of a double bond at the end of the hydrocarbon chain. Systematic research upon the problem of the oxidation of such a definite compound would then be possible, and would be much more satisfactory than investigations upon a complex mixture of unknown composition.

If, too, definite chloro-derivatives could be produced, one of the obstacles would be removed from the path of the Zelinsky process, although, in this process, the difficult problems of the starting, control and direction of the Grignard reaction, and the discovery of a suitable solvent would still remain.

These problems are, however, well in the future. Until the complicated mixtures of hydrocarbons of many different series which exist in the natural petroleums have been studied in great and almost wearisome detail, that is, until we know what we are working upon, and can separate different compounds which react specifically, we shall not solve the problem of the production of fatty acids, unless we do so by chance.

Synthetic fats.—Assuming that fatty acids could be produced in good yield, and sufficiently cheaply, by a process similar to one of those indicated above, the question of the formation of esters, glycerides or anhydrides suitable for edible purposes still remains. This should not be too difficult a matter. In the later years of the war 70—80 tons of "ester oil" per month was produced in Germany by the esterification of fatty acids (not synthetic) by means of ethyl alcohol or glycol.

Nevertheless, there are many problems of great importance connected with this question of synthetic fats. The various glycerides which constitute natural fats are many in number, and occur in a large variety of mixtures. To simulate a natural fat, with its mixtures of simple and mixed glycerides, would be no easy task, and the physiological study of compounded synthetic fats would have to be undertaken if such fats are to compete with natural fats in open market, and not merely to be supplied as prisoners' rations, or doled out to a starving population in blended margarines.

In the event of the fats obtained by the use of glycol or of mono- or poly-hydroxyl alcohols not being satisfactory, the esterification of synthetic fatty acids with glycerin would produce the analogues of natural glycerides. In this case, an opening would be provided for the development on an economic footing of the "Protol" glycerin process, in which suitable sugar-containing solutions are fermented under special conditions of alkalinity to produce glycerin, with alcohol, acetaldehyde, etc., as by-products.

Research would also be stimulated in the direction of using poly-hydroxyl alcohols, such as carbohydrates, for the esterification of synthetic fatty acids, and "fats" akin to the mannitan di-oleate, recently prepared by Lapworth, would result. Mannitan di-oleate was, of course, not produced by direct esterification, but there is no doubt that such an esterification is possible, and that the production of a fat of approved physiological value can be successfully accomplished.

Natural fats.—The problem of rendering petroleum available as a source of human energy by producing synthetic fats is therefore one which will only be solved after a very large amount of intensive and exhaustive research has been successfully undertaken. In passing, however, it is suggested that a more studied consideration of possible developments in natural vegetable-oil production would remove all fear of competition at the hands of the synthetic chemist. With careful selection of species, and systematic experiments in the production and application of suitable fertilisers, and with all the arts of the quickly-growing science of arboriculture, it should be possible greatly to increase the yield of oil per acre of ground cultivated. The fact that a similar study in the sphere of natural indigo has enabled the latter to compete with the synthetic product, so long its master economically, is significant in this connexion.

The production on a technical scale of fatty acids from petroleum hydrocarbons would appear to be possible, if remote: and were a successful process discovered, its general application would have but little effect upon the available supplies of mineral oil. Although the latter may be within measurable distance of exhaustion, the production of the million tons or so of edible oils and technically useful glycerides and fatty acids which are annually required in England would absorb such a small proportion of the hydrocarbon oil needed for other purposes that it would not become an important factor in petroleum economics. In August, 1920, the production of crude oil in America was about six million tons, and the consumption about seven million tons.

THE EFFECT OF ALKALINITY ON THE USE OF HYPOCHLORITES.

E. K. RIDEAL AND U. R. EVANS.

It is, of course, well known that hypochlorites are used very largely for the following purposes:—(1) Bleaching; (2) sterilisation of drinking water; (3) treatment of water for "textile finishing," to prevent growth of algæ and consequent stains; (4) addition to water of swimming baths; and (5) chloride of lime is employed freely as a deodoriser for household use, for the cleansing of drains, and, to some extent, as a disinfectant.

In the first case (bleaching), where the rapid oxidation of colouring matter is desired, *e.g.*, for wood pulp, it is a common practice to allow the hypochlorite to act in presence of acid; the bleaching is then very rapid. But in most other cases it is customary to apply small quantities of hypochlorite to the fluid to be treated, quite irrespective or whether the fluid be acid, neutral, or alkaline.

Now, in general, oxidising agents act most powerfully in the presence of acids. This is readily observed in the case of typical oxidising agents such as permanganates, dichromates, and perchlorates, which all tend to render the solution of the substance acted upon less acidic or more basic than it was before. In electro-chemical language this fact can be expressed by the statement that the oxidation potential of the agent is raised by an increase in the hydrogen-ion concentration.

The effect of acidity on the oxidising power of hypochlorite solutions is particularly marked, probably because, as has been suggested by one of us,[*] hypochlorous acid is the effective oxidiser, the oxidising power of the salts and of the anion, (OCl)′, being but feeble.

Whether this explanation be accepted or not, the facts cannot be doubted. The matter is expressed quantitatively by the following data from the oxidation potential series[†]:—

Potassium permanganate.. ..	$E_H = +1{\cdot}48$ volts.
Chlorine in acid solution	$E_H = +1{\cdot}39$,,
Chromic acid	$E_H = +1{\cdot}12$,,
Ferric chloride	$E_H = +0{\cdot}96$,,
Chlorine in alkaline solution ..	$E_H = +0{\cdot}86$,,

The table given indicates that chlorine in acid solution is nearly as powerful an oxidiser as potassium permanganate, and more powerful than chromic acid, whilst chlorine in alkaline solution (*i.e.*, hypochlorites) is less powerful than ferric chloride, which is far from being a vigorous oxidising agent.

It is not generally known, however, that a comparatively small change in the hydrion content of a water will produce a very marked change in the oxidising activity of the hypochlorite added. We have become very impressed with this fact in studying the dosage of different waters with hypochlorites by means of the electrical apparatus described by us some years ago.[‡] We find that two waters, one an "acid" water containing free carbon dioxide and the other an "alkaline" water, such as occurs in the London basin, dosed with hypochlorite so that they contain the same amount of "available chlorine" (as measured by the ordinary iodometric method with titration in presence of acetic acid), give quite different results when allowed to flow through the electrical instrument. The acid water gives a large deflection, indicating high oxidising activity; the alkaline water gives a much smaller deflection, indicating that the oxidation potential has been depressed.

It is interesting to note that the dissociation constants of hypochlorous and carbonic acids and water have the following values:—

Hypochlorous acid ..	$K = 3{\cdot}7 \times 10^{-8}$ at 17° C.
Carbonic acid	$K = 3{\cdot}0 \times 10^{-7}$ at 18° C.
Water	$K = 0{\cdot}7 \times 10^{-14}$ at 18° C.

Consequently, if sodium hypochlorite be added to water containing free carbonic acid, sodium carbonate and free hypochlorous acid will result; but in water in which the hydrogen-ion concentration is less than in hypochlorous acid, only a small amount of the oxidiser will be present in this active form.

Since the germicidal properties of the substance are in part due to its oxidising power, it seems likely that these also will be affected by the hydrogen-ion concentration of the water. It would be worth while, therefore, to consider whether, if alkaline waters have to be treated with this class of steriliser, they should not at the same time be rendered just acid to litmus, or at least neutral, by the addition of nitre cake, aluminium sulphate, or even by treatment with carbon dioxide gas.

But there is another equally important point. Most hypochlorite liquors, whether made on the spot by treating bleaching powder with water, or brought from the factory as sodium hypochlorite solution, have an alkaline reaction. Just because they react less readily in alkaline solution, hypochlorites "keep" better in the presence of alkali, and the manufacturers are scarcely to be blamed if their products leave the works with more than a trace of alkali. But users should remember this fact, and neutralise the alkalinity of the solution before using it to treat contaminated water.

It is worthy of mention that some of the chloride of lime sold at small oil-shops and by grocers is largely decomposed before it reaches the user. Now the decomposition may proceed in various ways, but some at least of these cause the bleaching powder to become more alkaline as it decomposes. Supposing, therefore, that the bleaching powder has lost half its "available chlorine" (as measured iodometrically) by the time it reaches the consumer, it is not even true to say that the unfortunate user can make up for the loss in transit by employing a double quantity, since the extra alkali present has a depressing effect upon the oxidising properties of the substance remaining.

The variable character of the chloride of lime—as it reaches the consumer—appears to have very considerable public importance. One sample of chloride of lime (packed in paper), purchased by one of us at a local store, was found to contain only traces of available chlorine. Presumably the average user of the substance is not a chemist, and does not know that he is buying a valueless article. One cannot but conclude that, assuming the domestic use of chloride of lime by the customers of these stores to be necessary at all, they are running serious risks, since the safeguards which they imagine that they are taking are illusory. This is a matter to which public analysts would do well to pay serious attention. It is useless to blame the shopkeeper if manufacturers supply the substance in paper cartons permeable to carbon dioxide.

The strength of chloride of lime as it reaches the consumer in tropical countries has recently been discussed in this *Journal*.[*] It is, however, remarkable how little the unstable character of chloride of lime—even at low temperatures—is appreciated. It decomposes very speedily if exposed to damp air or to carbon dioxide. On the other hand, sodium hypochlorite solution of a good brand has proved, in our experience, much more satisfactory as a source of hypochorite so long as it is kept in a cool place, protected from light, and tightly sealed to exclude carbon dioxide.

In view, however, of the difficulty of preserving hypochlorites, it is worth considering whether liquid chlorine could not usefully be employed for many purposes where hypochlorites are now used. As long as it is in cylinder, chlorine cannot decompose, and when dissolved in water the main primary reaction is believed to be:—$Cl_2 + H_2O = HCl + HClO$. Both of the substances produced are acid, and one is a strong oxidising agent.

Summary.—The oxidising power of hypochlorite solutions is greatly depressed by the presence of alkali. This fact should be borne in mind when it is proposed to use hypochlorites for treating alkaline waters; and the simultaneous addition of nitre cake is suggested.

Where alkali has been added as a stabiliser to commercial hypochlorite solutions, it may be advisable to neutralise before using the liquor for dosage. The instability of chloride of lime, and the poor quality of many of the samples supplied in paper packages by small stores, are matters of importance.

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[*] E. K. Rideal, J. Chem. Tech. (1912), 141.

[†] As given in W. Ostwald's "Outlines of General Chemistry."

[‡] E. K. Rideal and U. R. Evans, Analyst, **38** (1913), 353.

[*] J. Rettie, J. L. Smith, and J. Ritchie, J. Soc. Chem. Ind., 37 (1918), 211T.

MEETINGS OF OTHER SOCIETIES.

ROYAL PHOTOGRAPHIC SOCIETY.

At the meeting held on February 8, arranged by the Scientific and Technical Group, Mr. T. Thorne Baker read a paper, by himself and Dr. M. Levy, on "High-Speed Radiography." A short statement on the present possibilities and requirements in X-ray work, with special reference to the use of calcium tungstate intensifying screens, led to a description of the new rapid X-ray plate. This is a double-coated plate, the lower film being light-sensitive, the upper one containing fluorescent calcium tungstate. As it is necessary to remove the top film before development, the lower film is specially hardened to stand prolonged soaking at 110° F., and a soft gelatin, dissolving easily in water at 95° to 105° F., is used for the upper film. The calcium tungstate is fired at a special temperature to obtain maximum fluorescence. The grains are sifted and only those between certain limits of size are used; smaller grains give less intense fluorescence and larger grains tend to make the image granular. The coating of the upper film is so arranged that the calcium tungstate settles to the bottom of film into close contact with the emulsion surface; this ensures maximum effect of the light emitted and enables the use of a much smaller quantity of calcium tungstate than is needed for an intensifying screen. The reduction of exposure required by this plate in comparison with an ordinary X-ray plate depends upon several factors and varies from 1/10″ to 1/25″; better results are obtained with a hard tube than with a soft one. It was suggested that the new plate would be particularly useful in radio-metallurgy.

Mr. F. F. Renwick gave a short abstract of a paper received from Mr Raymond Davis, of the U.S. Bureau of Standards. The multiplying factors of photographic light-filters are obtained by an apparatus comprising a movable lamp and a series of mirrors permitting the illumination of two adjacent portions of a photographic plate by lights of known relative intensities. A series of exposures is made with the filter in one path, the results plotted, and the position of equality determined from the curve obtained.

Mr. F. C. Toy, of the British Photographic Research Association, described a monochromatic illuminator designed chiefly for use with a mercury arc lamp. This is a simple device enabling the separation of any two bands of a spectrum, and the variation of the lengths of the two bands used can be adjusted to equal intensities by the aid of a thermopile and galvanometer. Known variation in relative luminosities of the two beams is then obtained by varying the distances of the recombining lens and the plate which receives the recombined image.

THE PHYSICAL SOCIETY.

The annual general meeting was held at the Imperial College on February 11, and after reports had been presented and officers elected, etc., a discussion was held on "Absolute measurements of electrical resistance and instruments based on the temperature-variation of resistance."

Sir Richard Glazebrook traced the historical development of absolute measurements of electric resistance, and Prof. Callendar dealt with the compensated resistance bridge and instruments for the measurement of radiation. Among the thirteen other papers read, mention may be made of the following as having some application in chemical industry. These papers illustrated the diversity of ways in which one of the fundamental devices of electrical measurement—the Wheatstone bridge—has recently been applied in the measurement of various physical quantities.

A liquid depth-gauge, enabling a reading of the depth of liquid in a vessel to be made at any distance from the vessel, was described by Mr. E. A. Griffiths. The instrument consists essentially of a Wheatstone network of four conductors, two of which, in opposite arms of the bridge, are wires of the same material, extending to the depth of the vessel. One of the wires is completely surrounded by a sheath to protect it from contact with the liquid. The other is similarly surrounded, but the sheath is provided with holes near the bottom and top, so that the wire is in contact with the liquid over a length equal to the depth of liquid in the vessel. The wires are heated by the current in the bridge and the original balanced condition of the bridge when the vessel is empty, is disturbed to an extent dependent upon the depth to which the one wire is in contact with the liquid. Constancy of current in the bridge is maintained by the use of a ballast resistance of iron wires enclosed in an evacuated space. The galvanometer employed is graduated so that its deflections indicate directly the depth of liquid in the vessel. The whole device is made up in a compact form, the indications are independent of temperature, and can be transmitted to any distance.

A strong and portable form of hot-wire anemometer was exhibited and described by Mr. J. T. McG. Morris. The Wheatstone bridge employed is composed of four nickel wires, alternate arms being shielded. When the device is exposed to an air stream the initial balanced condition of the bridge is upset owing to the cooling effect of the stream on the exposed wires, and the galvanometer deflections, after suitable calibration, indicate the velocity of the air stream in which the instrument is immersed. This device has been used to investigate the ventilation of mines, and should be applicable wherever measurements of air velocity are required (*e.g.*, air supply to producers, power plant, etc.), its indications being much more easily read than those of the Pitot tube. A form of hot-wire anemometer enabling the velocity of a slow-moving stream of gas to be determined, both as regards magnitude and direction of flow, was exhibited and described by Dr. J. S. G. Thomas (*cf.* J., 1920, 109 R). A combined form of instrument of the anemometer type, in which the exposed wire functioned first as a thermometer and then as the exposed wire of a hot-wire anemometer was described by Mr. A. H. Davis. The indications of such a device enable the heat loss by convection from heated bodies to be accurately determined. It has been used in investigating the thermal efficiency of various systems of cold storage.

Dr. G. A. Shakspear exhibited and described his gas permeameter, which contains a bridge-device of four fine wires similar to that mentioned above. Owing to the varying thermal conductivities of different gases, the heated condition of appropriate wires is dependent upon the composition of the gas in which they are immersed. After suitable calibration of the instrument, the galvanometer deflections indicate the percentage amount of any one constituent of the mixture present. Hydrogen is pre-eminent among gases for its extremely high thermal conductivity (hence the cold sensation experienced on plunging the hand into the gas), and the author's device has been extensively used to determine the purity of the hydrogen supplied for aeronautical purposes in the investigation of the permeability of balloon fabrics, etc. A modification of the permeameter, in which the indicating instrument is suitably calibrated, constitutes the CO_2-recorder described and illustrated by Dr. H. A. Daynes. Prof. L. Hill exhibited the "caleometer," a bridge device enabling a record to be obtained of the state of the atmosphere as affording comfort or otherwise.

The familiar hair type of hygrometer has been modified by Dr. E. Griffiths so that its indications may be transmitted to a distance. The length of the hair employed is dependent upon the hygrometric state of the atmosphere, and the changes of length accompanying change of hygrometric state are transmitted mechanically to a pointer which makes contact with a long length of wire, the point of contact varying with the length of the hair. The two portions of the wire, one on either side of the point of contact, constitute two adjacent arms of a Wheatstone bridge, and it is evident that the indications of the galvanometer device employed will serve, after suitable calibration, to indicate the hygrometric state of the atmosphere surrounding the hair.

THE CHEMICAL SOCIETY.

At the ordinary scientific meeting held on February 17, ninety-seven new Fellows were elected, and Sir J. J. Dobbie, retiring president, made the following announcements:—

The Longstaffe Medal has been awarded to Prof. J. F. Thorpe. On the evening of the Annual General Meeting, March 17, the Anniversary Dinner will be held at the Hotel Cecil, Strand, W.C., at 7 p.m., to which the past-presidents who have attained their jubilee as Fellows of the Society will be invited as guests of honour. Applications for tickets (14s., exclusive of wine) should be made to the Assistant Secretary, at Burlington House, by March 10, and the presence of ladies as guests will be welcomed. The Council has decided to publish the list of physico-chemical symbols drawn up by the International Association of Chemical Societies.

Mr. L. J. Hudleston and Prof. H. Bassett contributed a paper on "Equilibria of Hydrosilicic Acid. Pt. I. Mixtures of Hydrofluosilicic and Hydrofluoric Acids," which contained a record of experiments on the titration of these acids with alkali in presence of phenolphthalein or methyl orange, and a theoretical interpretation thereof. Mr. Hudleston stated that they had not been able to purchase even approximately pure hydrofluoric acid, the samples supplied containing over 50 per cent. of hydrofluosilicic acid. Further, the "A.R."-test for determining silica in solutions of hydrofluoric acid was found to be valueless.

Mr. W. C. Reynolds summarised briefly two papers on Interfacial Tension, in the first of which he described a capillarity method of measuring it in C.G.S. units, and adduced results comparing it with the dynamical or "drop" method. In the second he showed that the interfacial tension between two pure liquids, A and B, is the difference between the surface tension of A saturated with B and the surface tension of B saturated with A; that the interfacial tension between pure liquids is constant at any given temperature; and that aqueous solutions of crystalloids behave like a pure liquid. The interfacial tension between aqueous sols of soap and colloids in contact with benzene was found to vary with the age of the contact surfaces. They probably conform to the law at the moment of contact, but owing to surface concentration the tension changes. In soap sols the concentration is complete in a few minutes, but in colloidal sols generally it proceeds for several hours. In cases where the interfacial tension is not constant, its measurement affords a means of detecting chemical or electrical action, or the presence of impurities in liquids.

Mr. F. W. Atack criticised the Hantzsch-Werner hypothesis of the geometrical isomerism of carbon-nitrogen compounds, and dealt with the constitution of oximes, and Prof. Bassett communicated a short note on the system: picric acid—phenylacridine.

THE FARADAY SOCIETY.

A joint meeting of the Faraday Society and the Manchester Literary and Philosophical Society was held in Manchester on February 11. The chair was first taken by Sir Henry A. Miers, and then by Prof. A. W. Porter.

Dr. Allan Ferguson read a paper entitled "Studies in Capillarity. I. Some General Considerations and a Discussion of Methods for the Measurement of Interfacial Tensions." He pointed out the importance of accurate measurements of surface tension in view of the developments in colloid chemistry, and stated that a critical study of the various methods in systematic use had shown the following to be the most promising:—(1) The measurement of large drops and bubbles. (2) The measurement of the maximum pressure required to release a bubble of air from the end of a capillary tube immersed in the liquid. (3) The measurement of the maximum pull on an anchor ring, which is immersed in the liquid and then slowly withdrawn from it. The capillary-tube method was discussed, and it was shown that a comparatively simple mathematical analysis for the ascent of a liquid in a capillary tube gave the sufficiently accurate expression:—

$$2a^2 = rh\left(1 + \frac{1}{3}\frac{r}{h} - 0{\cdot}1288\frac{r^2}{h^2}\right),$$

where a^2 is the specific cohesion, and h the height to which the liquid rises in a tube of radius r.

Dr. Ferguson then read a second paper by himself and Mr. P. E. Dowson on "A Modification of the Capillary-tube Method for the Measurement of Surface Tensions." In this new method the meniscus is forced down to the end of the capillary immersed vertically in the liquid, and the pressure required to effect this is measured on a manometer. This procedure avoids most of the difficulties of the usual method. Temperature measurements and control become simple, and calibration of the capillary is not necessary, for measurements are always made in one definite position—at the end of the tube. Any manometer of sufficient delicacy may be used, such as a differential manometer, or one of the simple sloping-tube type. The following values were obtained for the surface tension in dynes/cm.:—Benzene (15° C.) 29·66; toluene (15° C.) 29·23; methyl propionate (15·5° C.) 26·09.

In the long discussion which followed, Prof. Porter said he had had considerable experience in measuring the surface tension of mercury; he had photographed large drops and had found that the method of illumination was an important factor. He regarded the new method given by Dr. Ferguson as much more satisfactory than that of measuring the capillary rise. Mr. F. C. Thompson said that he was especially interested in the applications of surface tension to metallurgical problems and gave examples in connexion with the constitution of steel. Dr. R. S. Willows said that surface tension data were of particular importance in connexion with the formation of emulsions, and he asked for a simple method he could apply. Prof. Haldane Gee referred to the work of Quincke, who is still working at the age of 87 on the subject at Heidelberg, and who has recently advanced a new theory of the constitution of glass depending on surface tension. Prof. A. Lapworth referred to the values obtained by Dr. Ferguson and Mr. Dowson for benzene,, which were found to change with time; this required further investigation.

ASSOCIATION OF BRITISH CHEMICAL MANUFACTURERS.

LORD MOULTON ON "KEY" INDUSTRIES.

A luncheon was given by the Association of British Chemical Manufacturers on February 16, at Prince's Hotel, W., in honour of its president, the Rt. Hon. Lord Moulton, for his services to chemical industry during and after the war. Among those present were the Rt. Hon. Sir Alfred Mond, the Rt. Hon. Lord Inverforth, Sir William Pearce, Sir William Pope, Sir Henry Birchenough, Sir Sydney Chapman, Sir Philip Magnus, Sir H. McGowan, Prof. W. H. Perkin, Prof. H. E. Armstrong, Dr. M. O. Forster, Mr. Max Muspratt, and Mr. W. J. U. Woolcock.

Sir William Pearce, who presided, in proposing the health of Lord Moulton, referred to his accomplishments as senior wrangler, great lawyer, administrator, chemist and scientist, and said that the recent passage of the Dyestuffs (Import Regulation) Bill through the House of Lords was largely due to his advocacy. That Act must now be supplemented by further legislation to secure the future of the synthetic organic chemical industry, a branch of the main industry which had long been recognised and fostered by the German Government as one of the most important. It was essential that our Government and country should recognise its supreme value and legislate accordingly.

Lord Moulton, in his reply, said that this was a most critical moment in the existence of the British chemical industry and, through it, in the existence of England. During four years of the war he had endured terror of what the German chemical industry had enabled our enemies to do; he was always urging the Treasury to buy ahead from Chile the nitrate which the Germans were making in unlimited quantities at home, and he was afraid to think what would have happened if Germany had concentrated her submarine attack on that narrow line through the Panama Canal by which we obtained our supplies. In this, and in many other ways, we were reminded of the consequences of the neglect by the British nation and the British Government of the chemical industries during the 30 or 40 years before the war.

Referring to the old war-cry of Free Trade *v.* Protection, Lord Moulton said that we in this country were too fond of adopting political formulæ and calling them principles. As an old Free Trader, he used to say that the quickest way to obtain national wealth and to enjoy it was to buy in the cheapest market. That definition must now be elaborated as follows:—"If your main object is the rapid acquisition of wealth and the enjoyment of wealth, *and if you are sure of continuous peace*, then the best way is to buy in the cheapest market." Unfortunately we could not rely on a continuous peace, and the rapid acquisition and enjoyment of wealth could only be regarded as the highest good if it included the perfect development of our greatest asset—our own people. We had allowed ourselves to grow up as a nation utterly insufficient for ourselves, depending on others for the supply not only of manufactured goods, but also of many raw materials. When he looked back on the confident utterances of the old-time Free Traders, he was surprised that some of them did not insist that we should contract with Krupp for our war material and accept his tender if it were the lowest. Now they knew that they dare not be dependent on a foreign country for munitions of war; but they did not recognise that there were other things just as essential for use in peace. We no more dare leave our great industries at the mercy of a foreign country than we dare trust to a foreign country for our guns and ammunition. It was quite impossible to prop up every industry that did not make itself industrially remunerative, but when as a result of long national neglect the country had called on industries to initiate and develop new branches during the war, to expend capital on them and to develop research, it was the country's duty to protect those industries until the crisis was passed; and to think that they could withstand unrestricted competition while yet in a state of infancy was sheer folly. The problem would not be permanently solved by means of subsidies or import duties. His experience during the war had given him unlimited faith in British chemistry, both theoretical and industrial, and he declined to regard our chemists as in any way inferior, except as regards experience, to those of any other nation. He had always supported the system of licensing under which protection was secured for British goods so long as they were produced at home at fair prices and of equal quality; such a system would afford our manufacturers a breathing space in which to develop, not as a favour but as a right. their power of production until they needed no help and feared no enemy.

CORRESPONDENCE.

THE FINE CHEMICAL INDUSTRY.

(*Communicated by the Association of British Chemical Manufacturers.*)

Sir,—We, the undersigned, makers of fine chemicals, extended our research and manufacturing plant at the urgent appeal of the State during the tremendous years that followed 1914, in order to secure those essential products of science without which victory could not be attained. The full record of wartime achievements in the sphere of fine chemicals would read like a romance were the full history disclosed.

This key industry is now endangered, and unemployment is rife in it, owing to the flood of imports from abroad which, among other circumstances, the present condition of the exchanges makes devastatingly possible.

We desire to submit to public knowledge the following facts:—

1. The application of chemical science to industry is a necessary factor for the preservation of our world position in commerce. It is also true to say, not only that the chemist and the laboratory are in this country of a fine chemical industry not inferior pivotal in the development of our industrial and commercal resources and wealth.

2. At very consderable cost, essential plant was erected during the war-years, and all of it can now be put to peaceful purposes for the continuance in this country of a fine chemical industry not inferior to Germany's. But, under the present unfair economic circumstances, this plant must become idle and useless, unless the State takes measures for its safeguarding.

3. The fine chemical industry, mobilised and expanded in the hour of the nation's needs, provided during the war—to give a few examples—(*a*) essential medicinal preparations for naval, military, and civilian hospitals; (*b*) the higher forms of explosives and gases; (*c*) photographic chemicals for aerial use; (*d*) research chemicals, without which the development of many new industrial processes would have been impossible.

4. British science is no whit inferior to that of competing nations, nor are British chemical manufactures inferior in quality.

We feel it is our bounden public duty to make known to the country the national importance of an industry which is indeed a key to the unlocking of many doors of economic wealth in the future.—We are, etc.,

Stafford Allen & Sons, Ltd.
A. Boake, Roberts & Co., Ltd.
Boots Pure Drug Co., Ltd.
The British Cellulose & Chemical Manufacturing Co., Ltd.
The British Cyanides Co., Ltd.
The British Drug Houses, Ltd.
British Vegetable Products, Ltd.
Burroughs, Wellcome & Co.
W. J. Bush & Co., Ltd.
J. M. Collett & Co., Ltd.
Evans, Sons, Lescher & Webb, Ltd.
Grays Dyes and Chemical Works.
Hopkin & Williams, Ltd.
Howards & Sons, Ltd.
Johnson & Sons, Manufacturing Chemists, Ltd.
London Chemical Works, Ltd.
May & Baker, Ltd.
Thos. Morson & Son, Ltd.
Pierson, Morrell & Co., Ltd.

Feb. 19, 1921.

NEWS AND NOTES.

Petroleum Research.—The American Petroleum Institute intends to create a department of research, and its board of directors has recommended that three engineers be appointed, one to investigate oil-field problems, another to investigate the refinery problems, and a third to deal with problems relating to the distillation of petroleum and its products.

Colloid Chemistry.—Attention is drawn to a discussion of research problems in colloid chemistry by Dr. W. D. Bancroft which began in the January number of the *Journal of Industrial and Engineering Chemistry*. In his first communication Dr. Bancroft discusses seventeen problems under the general head of "Adsorption of Gas or Vapor by Solid," fourteen under "Contact Catalysis," three under "Adsorption of Vapour by Liquid," and nine under "Adsorption of Liquid by Solid."

Improved Yield of Methyl Alcohol in Wood Distillation.—A report will soon be published by one of the Government laboratories outlining experiments which have indicated the possibility of practically doubling the yield of methyl alcohol from the distillation of certain woods if a very small percentage of a certain chemical compound be first sprayed upon the wood. Encouraging results have been obtained in the laboratories from the use of sawdust, but it remains to be seen whether any practical difficulties will limit the size of pieces which can be treated. If such improved yields can be obtained commercially in the treatment of wood waste, certain perfected methods for the distillation of these wastes will be put on a very sound basis.

Ethyl Alcohol from Wood Waste.—The United States Forest Products Laboratory at Madison, Wisconsin, has prepared a pamphlet describing the production of ethyl alcohol from wood waste. The pamphlet includes estimates of plant requirements and cost data compiled from recent experiments at the laboratory. It is shown that with 180 tons of wood waste available daily, 3600 galls. of alcohol can be produced at a cost approximating 25 cents a gallon. The soft woods give the highest yields of 95 per cent. alcohol per ton of wood; white spruce heads the list with 25·8 galls., longleaf pine is next with 25·1 galls. The smallest yields are obtained from hard maple, red oak, cottonwood, and slippery elm, the first of these yielding but 9·1 and the last 6·0 galls. per ton.

AUSTRALIA.

South Australia.

Lignite Deposits.—A recent report of the Department of Mines states that the rise in the cost of imported fuel during recent years and the dislocation of industry through the interruptions in marine transport have drawn attention to all domestic sources of supply. In this connexion there is a revival of interest in the lignite deposits near Moorlands, where prospecting is now being actively pursued.

The lignite exposed in the workings has a somewhat variable appearance. The dull earthy and structureless body contains fragments of partly carbonised wood in which the fibres are plainly visible. There are a few irregularly shaped pieces of lustrous lignite and many traces of resin throughout the bed. The coaly matter contains much pyrites disseminated throughout the body of the carbonised wood. The following methods of utilising this lignite have been suggested:—(1) The generation of power with the aid of steam produced from specially designed furnaces burning the raw lignite. (2) The generation of producer gas from the raw fuel and the recovery of by-products. (3) Utilisation of the pulverised fuel for raising steam. This method involves the artificial drying of the lignite. (4) In the form of briquettes manufactured from the lignite after drying. (5) The carbonisation of the lignite with recovery of the by-products by distillation.

In view of the vital importance of fuel supplies to the State, the Government has purchased a modern drill, and boring operations, designed to prove the extent and quality of the brown coal deposits of the State, are in progress in the vicinity of Adelaide. The Government has also allocated £5000 for experiments on pulverised coal from Leigh Creek. The tests will be designed primarily to ascertain the value of this coal for use in railway locomotives, but they will be extended to other domestic fuels, such as the lignite of Moorlands.

BRITISH INDIA.

First Forecast of Winter Oil-seeds.—The total area under rape and mustard, excluding the mixed crop in the United Provinces, is estimated at 2,835,000 acres, or 13 per cent. below the estimated area in 1919–20. The percentage distribution of this area is as follows:—United Provinces 40·2, Bengal 19·4, Punjab 16·2, Bihar and Orissa 11·7, Assam 4·6, Bombay and Sind 4·7, North-West Frontier Province 1·8 per cent. The total estimated area under linseed is 1,755,000 acres (excluding the mixed crop in the United Provinces), representing a decrease of 23 per cent. The proportion sown by each province is:—Central Provinces and Bihar 35·3, United Provinces 29, Bihar and Orissa 23, Bengal 5·5, Bombay 5 and Punjab 1·2 per cent. Owing to deficient rainfall, the conditions for sowing were generally unfavourable. Rain is urgently wanted in most of the provinces and the condition and prospects of the crops are only fair.—(*Indian Trade J., Jan.* 7.)

JAPAN.

Petroleum Production.—The output of crude petroleum in Japan during the first six months of 1920 was 38,181,675 galls., compared with 38,891,918 galls. during the same period of 1919. Over 99 per cent. of the production was obtained in the prefectures of Niigata (Echigo) and Akita.—(*Sekiyû Jihô, Nov.*, 1920.)

CANADA.

Maple Sugar "Sand."—During the evaporation of maple sap to the state of syrup, a precipitate technically known as "sand" is deposited. It contains 60—80 per cent. of calcium malate, and its annual production from all the trees in the United States and Canada is estimated to be 100—330 tons, corresponding to 50—165 tons of calcium malate. Previous to the war it was bought by a German manufacturer of fine chemicals, and efforts are now being made to interest chemists in other countries in the possible uses to which this by-product may be put. As the acid constituent of baking powder, calcium bimalate gives excellent results, but it can hardly be produced as cheaply as calcium acid phosphate or even cream of tartar. Other applications, either of the normal or acid salt or of malic acid, are being investigated. In the case of no other source of malic acid can extraction be so readily effected, it being necessary only to convert the normal to the acid salt, and the latter being much more soluble in hot than in cold water is easily separated in a comparatively high state of purity by re-crystallisation.—(*Proc. 27th Annual Meeting of the Vermont Maple Sugar Makers' Association.*)

FRANCE.

Industrial Notes.—*Chemical Industry.*—The closing down, either partial or complete, of factories in the dyeing, bleaching, and leather industries has led to a weaker demand which has affected prices. Wholesale dealers, fearing a sudden fall in prices, are eager to dispose of their stocks, even on unfavourable terms. On the whole, however, there is no panic and prices are steadily finding their level without any State interference. German competition is proving a great stimulant and many firms are extending their plant in order to increase output. The Tencé firm, which has a plant at Aubervilliers, is building a new factory at Bernes, near Persan-Beaumont, for the production of sulphates, chlorides, nitrates, and of hydrochloric, sulphuric and nitric acids in both pure and commercial grades. The Compagnie Nationale des Matières Colorantes has just begun to produce alizarin and other basic dyes, in addition to indigo, at its works at Villers-Saint Paul.

Metallurgy.—The outlook in the metallurgical market remains practically unchanged; iron ore is in poor demand and there are large stocks of minette. The warning given to German firms that unless they supply France with the coal and coke she needs their supplies of iron ores will be cut off, have caused them to seek for new sources of supply, notably in Sweden. Lorraine is now supplying the Ruhr district with only 10 per cent. of its requirements, which compares with 50 per cent. before the war. On the whole, there is a feeling of confidence in French metallurgical circles. Owing to stocks of raw material being very low, the French will be able to take advantage of the fall in prices in replenishing them. Prices of wrought iron and steel have fallen considerably, and French pig iron is now sold at a lower price than the British. The chief competition comes from Germany, where production costs are lower than in France.

GENERAL.

Research Chemicals and the Dyestuffs Act.—In response to an inquiry made by the Institute of Chemistry, the Board of Trade has intimated that it will issue general licences under the Act to approved research institutions for the importation of small quantities of organic intermediate products. The licences will cover periods of three months and be limited only as to total quantities. A detailed return of the quantities of each product actually imported must be made at the end of the three-monthly period.

The Textile Institute.—Colonel F. R. McConnel, of Manchester, is to succeed the late Sir A. Herbert Dixon, Bart., as president of the Institute. At the invitation of the Basle Chamber of Commerce the Annual Spring Conference will be held from May 17 to 20 at Basle, in co-operation with several leading textile organisations in Switzerland. During the conference lectures will be given on "The Dye Industry and its Future," "The Industrial Application of Electricity," "The Financial Situation," and "The Structure of Textile Fabrics." The programme includes facilities for visits to textile and other works.

Industrial Alcohol in Switzerland.—At a meeting held on January 5, convened by the Swiss Society of Chemical Industry and attended by representatives of all the larger firms which use alcohol in their manufactures, a resolution was passed condemning the decision of the National Assembly to extend the alcohol monopoly to industrial spirit. The meeting protested that the decision had been made without consultation with those whom it would affect, and affirmed that at the present time the restrictions attending such an extension of the monopoly would be fatal to the country's export trade.—(*Schweiz. Chem.-Z., Jan.* 25, 1921.)

Patents in Greece.—The first Greek patent law, passed early in the autumn of 1920, provides that every patent shall be granted on priority of application, shall cover only one invention, and have a life of 15 years, reckoned from the day following the date of application. The ownership of a discovery made in an industrial or commercial establishment is vested in the discoverer, and patents must be satisfactorily exploited within three years after coming into force, although this does not apply to nationals of countries that offer reciprocal treatment. In the event of a patent being declared of public utility, the owner must allow others to exploit it on payment of compensation. Foreign applications must be made through an agent resident in Athens and be subject to local jurisdiction. Where patents are registered in countries that allow reciprocal treatment the Greek law allows 12 months' priority from the date of the patent. Applications must be in Greek and be accompanied by an official certificate from the country in which the patent is registered. Patent specifications will be published at once, but may be kept secret for a year if requested.—(*Z. angew. Chem., Dec.* 17, 1920.)

State of the Swedish Chemical Industry at the end of 1920.—The situation in the Swedish chemical industry has been growing worse, and in consequence of falling prices in the world's markets and of the high wages now paid in Sweden, manufacturers have either to close down or to produce at a loss. Many branches of the industry are demanding increases in import duties. Hitherto ammonium sulphate has been imported freely, but the body which represents all the Swedish manufacturers of this fertiliser is asking for an import tax of 15 kroner per quintal (about £8 10s. per long ton, at par); the yearly output of ammonium sulphate, about 9000 metric tons, is far in excess of the home demand, as cyanamide is chiefly used for nitrogenous manuring, and the export trade is suffering severely from German competition. No improvement has taken place in the soap industry; sales of soft soap are poor and prices have fallen; most of the factories hold big stocks of soap and produce only sufficient to keep plants in operation. The amalgamation of the Kväveindustrie (nitrogen industry) and the Trollhätte Cyanidverk companies has fallen flat, and the necessary new capital not having been obtained, the directors have notified the suspension of operations. The Swedish Government has appointed an expert advisory commission to investigate the bad economic situation.—(*Z. angew. Chem., Jan.* 7, 1921.)

"Monazite (1913—1919)" (pp. 15, price 6d.) has been recently published by the Imperial Mineral Resources Bureau as an advance "part" of its annual volume on the Mineral Resources of the British Empire and Foreign Countries. Monazite, essentially a phosphate of the cerium earths, owes its commercial value to the presence of a variable amount of thoria which is extracted by chemical treatment and marketed in the form of thorium nitrate for use in the manufacture of gas mantles. The mineral is widely distributed in nature, but few deposits have been discovered which contain thoria in sufficient quantity to justify commercial exploitation. It is found in the form of an alluvial sand associated with other minerals, such as magnetite, ilmenite, garnet, and zircon, from which it is separated by hydraulic and electromagnetic methods to produce the concentrate as it is marketed. With the exception of small quantities of thorite and thorianite obtained from Norway and Sweden, the first deposits to be worked for monazite were those situated in the Carolinas. These deposits, patchy in distribution and poor in quality, could not compete with those discovered later in Brazil, which supplied the world's requirements until the monazite from Travancore, India, appeared on the market about the year 1911. The earlier history of the Travancore deposits, and the final obliteration of the German interests, have been already fully referred to in the pages of this *Journal* (*cf.* S. J. Johnstone, J. 33, 55, 35, 811, and 37, 373 R). The separated monazite is the highest grade on the market, containing about 8½ per cent. of thoria as compared with 6 per cent. in the best of the concentrates obtained from the Brazilian sands. To illustrate the variable thoria content, reference may be made to monazite discovered in such widely separated countries as Nigeria, Queensland, Malaya, and the United States, which, even when concentrated by the most perfect means commercially available, commonly contain no more than 4 or 5 per cent., and frequently considerably less. The present price of monazite is stated to be £4 12s. 6d. per unit of thoria per ton at the mine in Travancore. The c.i.f. value at European ports depends upon the cost of freight. In June, 1920, it was about £6 10s. per ton.

Statistics quoted include the world's production of monazite, imports into the United Kingdom (for some unstated reason these are given in values), and into the United States.

World's Production of Monazite.

Long tons (2240 *lb.*).

	1913.	1914.	1915.	1916.	1917.	1918.	1919.
India ..	1235	1186	1108	1292	1940	2117	2000*
Ceylon ..	—	—	—	—	—	20	—
Brazil ..	1415	590	433	—	1118	491	—
United States	—	—	16	17	—	—	—

* Estimated.

Thorium nitrate, worth about 23s. per kg. before the war, is now selling at about 38s. Before the war this country was dependent upon Germany; since the war and up to within the last year or two nitrate was imported from the States, but now British manufacturers apparently supply home requirements.

Value of Imports and Exports of Gas Mantles to and from the United Kingdom.

Year.	Imports. £	Exports. Domestic produce. £	Exports. Foreign produce. £
1913	302,576 ..	32,566 ..	5650
1914	199,299 ..	47,400 ..	4359
1915	236,075 ..	93,960 ..	4848
1916	57,067 ..	144,292 ..	7491
1917	24,106 ..	94 058 ..	—
1918	26,815 ..	103,297 ..	—
1919	31,771 ..	88,893 ..	—

The mixture of oxides in gas mantles is said to be derived from a mixture containing about 99 per cent. thorium nitrate and 1 per cent. cerium nitrate. Large quantities of cerium compounds are obtained as by-products in the manufacture of thorium nitrate, and new uses for this product, hitherto largely wasted, would be welcomed by the industry. At the present time the cerium is used for the manufacture of the alloy ferro-cerium, which usually contains about 30 per cent. iron, and which is used in the manufacture of sparking devices for carbide lamps, gas jets, and automatic cigar lighters. Cerium has also been suggested as a deoxidiser in the manufacture of steel and also in the "thermit" process for the reduction of metallic oxides, and its salts are used in the manufacture of flaming electric-arc lamps, in glass making, ceramics, and in medicine. Monazite is the chief source of mesothorium, which closely resembles radium in its properties. The amount present is only a few milligrams per ton of the monazite and apparently it is not extracted by the English manufacturers of thorium nitrate, although at least two manufacturers are producing mesothorium from monazite in the United States. Mesothorium is sold on the basis of its radio-activity compared with radium bromide, and was worth (June, 1920) from £6 to £8 per milligram.

In this connexion reference may be made to three recent publications in the United States, viz., "The Incandescent Gas-Mantle Industry" (United States Tariff Commission, 1920), "Thorium, Zirconium and Rare-Earth Minerals in 1919 (U.S. Geological Survey, 1920), and "The Mineral Industry" for 1919 (New York, 1920). The last states that during the war American manufacturers of thorium nitrate firmly established themselves, and every effort is now being made to pass protective legislation to prevent the flooding of the American market with low-priced German thorium nitrate, and claims that it is evident that a high duty should be placed on all imported thorium nitrate if the welfare of the American industry is to be considered, as the German producers have the advantages of cheap labour and longer hours, and the American producers cannot hope to compete with them. In the States prices remained comparatively firm throughout 1919, monazite sand ranging from $38 to $42 per unit, duty paid, equal to $228 to $252 per metric ton for a sand carrying a minimum of 6 per cent. of thoria. The prices of the nitrate remained steady throughout the year, ranging from $3.75 to $4 per lb. A small quantity of ferro-cerium, estimated not to exceed 10 tons per annum, is produced in the United States.

According to "The Incandescent Gas Mantle Industry," the productive capacity of the American plants shows an increase of 300 per cent.; 149,850 lb. of thorium nitrate was produced in 1913, and 439,304 lb. in 1917. The imports amounted to 1880 lb. in the latter year and 112,000 lb. in 1913. The same publication remarks that an *ad valorem* duty has been levied on the crude raw material, the refined intermediate product and the finished article, and if the duty is calculated on the basis of the content of the constituent of principal value, namely thoria, specific rates of duty obtaining in 1914 were as follows:— Monazite sand, $0.315 per lb. of thoria contained; thorium nitrate, $1.44 per lb.; and gas mantles, $7.48 per lb.

Finland in 1919.—The chief natural resources of Finland is timber, which covers an area of 77,200 square miles and is estimated to last about 145 years on the basis of an annual production of 300,000 tons of chemical pulp and 200,000 tons of mechanical pulp. Water power is also abundant, but only 150,000 h.-p. is in use, about 1,460,000 h.p. remaining unutilised. Several mines have been worked in East Finland, including the Outokumpu copper pyrites mine, which is estimated to contain at least 230,000 tons of copper and over 2 million tons of combined sulphur (*cf.* J., 1919, 27 R, 47 R).

Wood pulp and paper constitute the most important industries. Trade in these commodities was formerly mostly with Russia, although since 1903 there has been a steady market for Finnish wood pulp in Denmark, Germany, Holland, Belgium, England, and France. The following table gives the quantities (long tons) of mechanical pulp and board exported in 1913 and 1919:—

Wood Pulp.	1913.	1919.
Wet	8,916.5	12,504
Dry	39,750	50,861
Total	48,666.5	63,365
Pasteboard (wood)	52,884	910

Nearly all the wood pulp and board exported is supplied by the twenty-three mills belonging to the Finnish Wood Pulp Mill Union (Finska Trasliperiforeningen), which has a combined capital of 100 million Finnish marks (about £4,000,000 at par), and a total annual capacity of about 150,000 tons. Of the 1919 production, 5518 t. was sold in Finland and 74,609 t. exported, mainly to Germany, France, and England (in the order named).

The cellulose or chemical wood-pulp industry prospered in 1919, in spite of Canadian competition; 15 per cent. of the sulphite pulp and over 35 per cent. of the sulphate pulp were shipped to the United States. Almost all the exported material is produced by the members of the Finland Cellulose Association (Finska Cellulosa Foreningen), which comprises 18 sulphite mills (capital £8,000,000, annual capacity about 190,000 t.), and 6 sulphate mills (capital £4,000,000 and capacity 66,000 t.). The annual report of the association gave the production figures for 1919 as 68,900 long tons of sulphite pulp and 26,870 t. of sulphate pulp. Exports were as follows (long tons):—

Chemical Wood Pulp.	1919.	1913.
Wet	2,850	3.125
Dry	69,804	72,728
Total	72,654	75,853

Russia was the most important foreign market for Finnish paper until 1917, but when this was closed considerable difficulty was experienced in securing new markets owing to Swedish and Norwegian competition. Trade revived in the late summer of 1919, and increasing quantities have been marketed, particularly in England and the United States. The capacity of the 31 mills represented in the Finska Pappersbruksforeningen is estimated at about 220,000 tons, and their combined capital is over £10,000,000 (at par); the 1919 output was about 95,000 tons, and the sales 66,970 t., of which 44,800 t. was exported.

The metal industries have recently shown some recovery; production has increased by about 30 per cent. over that of 1918 and has reverted to its main object viz., that of supplying the country with machines, tools, and metal goods. The newly instituted eight-hour day is regarded with misgiving, but as it has also been adopted in Scandinavia and other countries, it is hoped that the industry will not be seriously affected.

Finland has two important Portland cement factories, with a combined annual capacity of 675,000 barrels, but this will soon be doubled; these factories also make lime for use in the cellulose factories. Coal is needed for this industry.

Raw materials having become available, the cotton factories resumed full work in the latter half of 1919, and the prospects of the industry are considered bright. It is stated that the textile manufacturers are very dissatisfied with the way they are treated by the German dyestuff firms, and that there is a good opening for other foreign dyes of good quality.

The manufacture and production of matches could become a very important industry, as 90 per cent. of the raw materials, notably poplar wood, is indigenous. Production was increased 10 to 15 times during the war; work was suspended when export to Russia was stopped, but resumed in 1918. The Swedish match trust has recently obtained control of the two largest factories and purchased a third. Exports of matches were 8·5 tons in 1913, 290 t. in 1918, and 855 t. in 1919.

The tar industry, formerly important, has declined greatly, production and export having become very small; the quantity of tar exported in 1918 was 529 galls., as against 13,636 galls in 1913.

The six sugar refineries were combined in January, 1919, into one limited company (Finska Socker), with a paid-up capital of 50 million marks (about £2,000,000 at par) and a total annual capacity of 60,000 tons of sugar. Sugar-beet cultivation has commenced on a small scale, and a factory began work in February, 1920.

Imports into Finland in 1919 were valued at £32,537,485 (£1 = 75·4 Finnish marks), and included:—Drugs, £117,252; gums, resins, etc., £535,150; oils and greases, £2,636,300; perfumes, £23,213; minerals and manufactures, £632,997; chemicals, £295,170; explosives, £70,961; colours and dyes, £181,698; and metals and manufactures, £2,271,067. Of the total imports, the United Kingdom supplied 27 per cent., followed by the United States with 25 per cent. The exports in 1919 were valued at £11,338,468, of which 43 per cent. was shipped to the United Kingdom.—(*U.S. Com. Rep. Suppl., Nov.* 11, 1920.)

LEGAL INTELLIGENCE.

AGENCY CLAIM AGAINST A COMPANY MANUFACTURING SALICYLIC ACID. *E. T. Pearson and Co. v. Sheppard's Chemical Works, Ltd.*

In the Chancery Division, on February 9, Messrs. E. T. Pearson and Co., of London, made an application that the liquidator of Sheppard's Chemical Works, Ltd., should be directed to admit their claim for £3918 as creditors of the latter company.

For the applicants it was stated that they were appointed sole agents for the sale of the salicylic acid manufactured by Sheppard's, and, as the agency was for a term of seven years commencing in June, 1916, it was claimed that the liquidation of the company in June, 18 constituted a breach of contract. The applicants had earned over £1400 in commission on sales, and there was evidence that the sale was increasing

On behalf of the liquidator it was stated that Sheppard's, Ltd., had not manufactured salicylic acid since it went into liquidation and was re-constituted as a new company, as the chemical could not be sold at a profit, the price having dropped from 22s.—23s. per lb. in 1916 to 2s. per lb. just before the company ceased operations. It was contended that the clause providing for the payment of £1000 when the agreement was ended was not a measure of damages.

Mr. Justice Astbury said that when there was a seven years' agreement it was not an answer to a breach of contract to say that the chemical could not be produced at a profit; the applicants, however, could not get more than the £1000 payable if the agency did not run the full term.

The parties finally arrived at a settlement by which the applicants, who held a sum of £273 for goods sold, were to retain £150 in full satisfaction of their claim and costs, the remainder to be held by the liquidator as a sum out of which the applicants would be indemnified against any claim brought against them in respect of bad quality of goods sold under the agency agreement.

OFFICIAL TRADE INTELLIGENCE.

(From the Board of Trade Journal for February 10 and 17.)

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W. 1, from firms, agents, or individuals who desire to represent U.K. manufacturers or exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department and quoting the specific reference number:—

Locality of Firm or Agent.	Materials.	Reference Number.
British W. Indies	Galvanised sheets	223
„	Glassware, crockery	224
Canada	"Stainless" steel, patent medicines	191
„	Pig iron	193
„	Indian linseed oil	*
„	Varnish	*
South Africa	Roofing (felt and other), rubber, paper, vulcanised fibre	222
„	Tinplate	222a
Belgium	Glass, earthenware, porcelain	200
France	Chemicals and raw materials, especially for the soap and perfumery industries	228
Italy	Lubricating oils, paint, varnish	207
Latvia	Shellac, gum sandarac, gums, resins, ceresin, montan wax, gilsonite, nigrosin	230
Spain	Tinplate, heavy chemicals, paper	209
Morocco	Glassware, china	235
Argentina Uruguay	Metals, chemicals, soap, dyes, candles, tinplate	241
United States	China, earthenware, glassware	211
„	Chemicals	240

* The High Commissioner for Canada, 19, Victoria Street, London, S.W. 1.

Market Sought.—A Canadian firm manufacturing oak and hemlock sole leathers wishes to get into touch with importers in the U.K. [Inquiries to the Canadian Government Trade Commissioner, 73, Basinghall Street, London, E.C. 2.]

TARIFF, CUSTOMS, EXCISE.

Antigua.—The revised rates of export duties on sugar, syrup, and molasses, with effect from January 1 to December 31, are given in the issue for February 10.

Austria.—Among the articles for which import licences are still required are sugar, malt, honey, paraffin, alcoholic beverages, vinegar, opium, essential oils, benzol oils, mineral oils, artificial silk, certain kinds of glass and glassware, stonewares, asbestos wares, earthenware, certain metals and wares, salt, many chemicals, varnish, perfumery, candles, and soap.

Articles for which export licences are still required include sugar, molasses, oil seeds, raw hides and skins, fats and oils of all kinds, vinegar, pyrites, certain ores, chalk, magnesite, opium, camphor, dyeing and tanning materials, gums, resins, mineral oils, tar, vegetable fibres, paper pulp, paper, rubber waste, cement, certain metals and wares, caustic potash and potassium salts, caustic soda, Glauber's salt, white lead, lead oxides, ammonia, and many chemicals.

Belgium.—Margarine and vinegar may now be exported without licence.

British India.—The revised Tariff Valuations are set out in the issue for February 17. They supersede those dated November 20, 1919, and take effect as from January 1.

Among the articles admitted duty free are hops, salt (under certain conditions), raw hides and skins, oil-seeds (under certain conditions), raw wool and cotton, wood pulp, quinine, trade catalogues, and certain substances when used for the weaving of cotton or the baling of cotton goods, *e.g.*, aniline blue, sodium sulphates, sodium carbonate, magnesium chloride and sulphate, zinc chloride, china clay, starch, sizing paste and wax, farina, glutina, and glycerin substitutes.

The export of cinchona bark is prohibited to all destinations except the U.K.

Bulgaria.—Revised export duties affect, *inter alia*, skins, hair, edible fats, certain oil-seeds, opium, rose oil, animal waste, scrap metals, paper and rubber wastes.

China.—A surtax of 10 per cent. of the existing customs duties will be levied as from March 1.

Egypt.—Sesame can now be exported without a special licence.

France.—The export duty on dephosphorisation slag is fixed at 1.50 fr. per 100 kg.

France and Algeria.—The "coefficients of increase" on calcium carbide, glass, paper, and cardboard have been modified.

French Colonies.—The export of sugar, crude gold, platinum and silver is prohibited to all destinations except France and French colonies.

Germany.—A list showing the export taxes leviable under section 6 of the Ordinance of December 20, 1919, may be seen at the Department, 18, Queen Anne's Gate, London, S.W. 1.

The import of lard, goose-grease, beef marrow and other fats similar to lard (but not margarine) is permitted without licence as from February 15.

Grenada.—An additional export duty has been levied on cocoa under certain conditions.

Italy.—Import may be authorised under certain conditions of certain glasswares, laboratory glassware, and photographic films.

Kenya.—It is proposed to allow free of customs duty the import of drugs, medicines and rectified spirit to be used solely in the compounding of drugs and medicines.

Malta.—Paraffin and stearin may now be imported duty free.

Palestine.—The import of explosives, nitre, salt, and "hashish" is prohibited.

The import of cocaine, sulphonal, picrates, and potassium and sodium chlorates is permitted only under special licence.

Portugal.—The full text of the Bill which provides for the complete revision of the customs tariff is set out in the issue for February 10. It is proposed to abolish, with a few exceptions, the surtaxes on import duties. The customs duties will be collected solely in gold. The proposed new schedule of duties covers practically all classes of goods.

Sweden.—Export prohibitions have been removed from peat, lard, tallow, milk powder, dripping, raw rubber, guttapercha and balata, caustic potash, potassium carbonate, chloride and sulphate, tartar emetic, salts of gold, platinum and radium, chlorides of tin, indigo, and unsweetened condensed milk.

Switzerland.—Export licences are still required for cocoa, chocolate, raw hides and skins, glue stock, fibres for the manufacture of paper, cotton waste, porcelain insulators, raw iron and wares thereof, copper ore, copper, gold, silver, platinum, potassium permanganate, saccharin, methyl alcohol, indigo and aniline, anthracene, naphthalene and tar colours not specially mentioned in the general tariff.

Tunis.—Essence of turpentine, and bauxite, may only be exported with the sanction of the Director-General of Finance.

Uruguay.—It is proposed to levy an additional duty of 15 per cent. on all imports, but not on certain oils, sugar, kerosene, charcoal, and a few other substances.

GOVERNMENT ORDERS AND NOTICES.

Overseas Trade (Credits and Insurance) Act, 1920.—By an order of the Board of Trade of February 17, 1921, the country of Austria was added to the Schedule to the Act.

Decontrol of Coal.—The Board of Trade has notified, under date February 14, that the Directions issued August 25, 1920, relating to maximum pithead prices for coal sold for home consumption and for bunkering vessels will cease to have effect as from March 1, 1921.

Prohibited Exports.—The Board of Trade (Licensing Section) announces that, by Order-in-Council, dated February 7, 1921, the export of:—Sulphate of ammonia; superphosphate of lime; basic slag; and compound fertilisers containing any of the foregoing substances is now prohibited under the Fertilisers (Temporary Control of Export) Act, 1920; and the Proclamation of May 10, 1917, as amended by subsequent Orders of Council, is revoked so far as it relates to:—Sulphate of ammonia and mixtures containing sulphate of ammonia; basic slag; manures, compound, containing either sulphate of ammonia, superphosphate of lime or potash; superphosphates. Applications for export licences should continue to be addressed to the Licensing Section, Board of Trade, Great George Street, Westminster, S.W. 1.

Determination of Combustible Matter in Coal Dust and Mixtures Thereof.—The Secretary for Mines has issued notices under the Coal Mines Act, 1911, concerning (*a*) the determination of combustible matter in dust mixtures which contain carbonates (Feb. 14), and (*b*) the testing of dust mixtures which contain such a high percentage of moisture that they cannot be sieved in the manner prescribed by the Regulations (Feb. 7).

(*a*) The sample is ignited in an open vessel to decompose completely the carbonates until the weight is constant; the percentage loss in weight is determined by treatment with acid; and the difference between the percentage losses so obtained is taken as the percentage of combustible matter.

(*b*) The sample, having been well mixed, is dried at 212° F. until the weight is constant, and the percentage of combustible matter is determined as under (*a*).

Dyestuffs Licensing Advisory Committee.—In accordance with the provisions of Subsection (3) of Section 2 of the Dyestuffs (Import Regulation) Act, 1920, the President of the Board of Trade has appointed the following Committee to advise the Board of Trade with respect to the granting of licences under the Act:—Mr. Vernon Clay (Joint Managing Director, Robert Clay, Ltd.); Mr. G. W. Currie; Mr. G. Douglas (Managing Director, Bradford Dyers' Association Limited); Mr. E. V. Evans (Hon. Treasurer, Society of Chemical Industry); Dr. M. O. Forster (Director of the Salters' Institute of Industrial Chemistry); Mr. C. C. Railton (Director, Calico Printers' Association, Ltd.); Mr. H. B. Shackleton (Messrs. Taylor, Shackleton and Co., Shipley); Mr. T. Taylor (Cornbrook Chemical Co., Stockport); Mr. S. A. H. Whetmore (British Dyestuffs Corporation, Ltd.); and Mr. W. J. U. Woolcock (General Manager, Association of British Chemical Manufacturers).

Pending the appointment of a permanent chairman, which it is hoped to make at an early date, Mr. P. Ashley, Assistant Secretary, Industries and Manufactures Department, Board of Trade, will act as chairman of the Committee. The Secretary to the Committee is Mr. W. Graham, and all applications for licences should be addressed to the Secretary, Dyestuffs Advisory Licensing Committee, Danlee Buildings, Spring Gardens, Manchester.

COMPANY NEWS.

SOUTH METROPOLITAN GAS COMPANY.

At the annual meeting held on February 9, the chairman, Dr. Charles Carpenter, stated that the company's Act of Parliament (*cf.* J., 1920, 310 R) authorised the payment of a dividend of 5 per cent. per annum on the issued ordinary stock (6 per cent. on future issues), and a dividend at this rate was now proposed in respect of the past year. The increase in expenditure, of which salaries and direct wages accounted for about 40 per cent. and coal for over 46 per cent., had been met by enhanced profits on the sale of residuals. The production of therms for the year was 70·45 per ton of coal carbonised, and there had been an increase of 5·43 per cent. in the sales of gas. Great trouble was still being experienced in obtaining clean coal, but with the passing of Government control an improvement in quality was to be expected. It was to be hoped that the pre-war practice of exporting much of our best coking coal would not be revived; recovery and marketing of the by-products could be done here quite as well as in Germany, and this course would be followed by great economic advantages to this country. Dye-intermediates were now being manufactured on an important scale, and the company was producing successfully a grade of ammonium sulphate equal to that produced in Germany; it was, however, to be regretted that the export of this material had been placed for two years in the hands of a trust. Given time and encouragement. our chemists could learn dye-making from the Germans, just as the latter had learned shipbuilding from us. Most unfortunately, the Government had not prevented the country being flooded with German dyes. of which £1,881,275 worth was admitted during November last; and it was to be hoped that the heat-resisting glass industry would fare better. It was proposed to promote a Bill in Parliament to make permanent the company's powers to raise capital authorised by the Acts of 1916 and 1918. Notwithstanding the fact that no co-partnership bonus had been paid for the past three years, the employees continued to work in full accord with the management.

TRADE NOTES.

FOREIGN.

The Vegetable Oil Industry of Marseilles.—This industry has of late experienced many vicissitudes, but the outlook on the whole is now brighter. In Marseilles there are 30 seed-crushing firms owning 48 mills and 2011 presses. The import of oil-seeds, normally about 60 per cent. of the total imported into France, and consisting chiefly of sesame, groundnuts and copra, amounted to 321,354 metric tons in 1919, and that of vegetable oils 78,438 t., compared with 589,597 t. and 40,927 t., respectively, in 1913. Olive oil is only of secondary importance to the industry. The French production, about 6000 t. per annum, is not equal to the demand, and supplies are imported from North Africa, Spain and Italy (*cf.* J., 1920, 217 R); the establishment of co-operative mills has proved beneficial. The exports of oil-seeds, oil, and oil-cake from Marseilles in 1919 were 9031 t., 3298 t., and 747 t., respectively, compared with 39,600 t., 52,055 t., and 132,837 t. in 1913. Coconut butter is manufactured on a large scale by four companies, which produced an average of 60,000 t. yearly before the war. Since then this industry has suffered from lack of raw materials and diminished export trade due to the development of the industry in other countries, particularly the United Kingdom. the exports having decreased from 19.510 t. in 1913 to 721 t. in 1918.—(*U.S. Com. Rep., Dec.* 20, 1920.)

The Dye Trade in Holland.—The future of the dye trade in Holland is uncertain, production is small, being mainly confined to three firms, and the textile trade complains that the domestic supply cannot be depended upon. Dyes are therefore being obtained from Germany, although Great Britain, Switzerland and the United States are furnishing an increasing supply; British and American dyes, however, have been criticised for lack of variety. The imports during the first eight months of 1920 amounted to 1825 metric tons (worth £795,330 at par), compared with 1318 t. in the same period of 1918, and included:—Aniline dyes, 1311 t.; other synthetic dyes, 5 t.; synthetic indigo, 350 t.; natural indigo, 5 t.; madder and natural dyes, 84 t.; and dyewood extract, 70 t. About 85 per cent. of the aniline dyes came from Germany, 8 per cent. from Switzerland, and the remainder from Great Britain and America; practically all the indigo and madder came from Germany and the dyewood extract from France.—(*U.S. Com. Rep., Dec.* 2, 1920.)

Foreign Company News.—*Japan.*—Five celluloid companies, the Chigusa Celluloid K.K., Royal Celluloid Co., Kazushiro Celluloid K.K., Juzen Shokai, and Hata Shokai, have combined to form a new company, the Central Celluloid Co., with a capital of 2,000,000 yen (£204,166 at par), of which 1,400,000 yen is paid up.

A company with capital of 1,000,000 yen is to be formed by the Japan Chemical Industrial Co. and other fertiliser manufacturers to develop the phosphate deposits in Hirata, an island south of Hainan Island.

The Imperial Gunpowder Industrial Co., established in November, 1919, with a capital of 10 million yen, to manufacture gunpowder, explosives, chemicals, and dyestuffs, will probably start production in March, but instead of making mining explosives it will manufacture for the naval department.—(*U.S. Com. Rep., Dec.* 21, *Jan.* 25, 1921.)

Italy.—A new company, the Società Generale dei Colori, with a capital of 5 million lire and power to extend it to 50 million lire, has been formed at Milan to manufacture mineral colours, thus introducing a new industry into Italy.—(*Z. angew. Chem., Jan.* 28, 1921.)

Sweden.—It is reported that Lever Brothers, Ltd., will shortly dominate the whole Swedish soap industry by acquiring control of seven soap firms, the combined capital of which is about 10½ million kronor (about £590,000 at par). Seven per cent. preference shares in a holding company will be given in exchange for shares in the Swedish companies.—(*Z. angew. Chem., Dec.* 17, 1920.)

BRITISH.

Uganda in 1918–19.—In view of the demands made upon this Protectorate by the war, the results achieved during 1918–19 were quite satisfactory, but as new capital has not been available since 1914, industrial enterprise has been restricted to its former channels. Cotton is the chief product; the value of the crop in the year under review was £965,951, and the area under cultivation, now being rapidly extended, was nearly 150,000 acres. Para rubber was grown over an area of 11,255 acres, and production is increasing yearly; 113 tons was exported. Ceara and Funtumia rubber do not repay exploitation. The production of oil-seeds could be extensively developed; only small quantities of groundnuts, castor seed and sim-sim are at present obtained. The forests of Uganda would well repay exploitation.—(*Col. Rep.—Ann., No.* 1054, *Dec.*, 1920.)

Zanzibar in 1919.—The most important industry in Zanzibar is the cultivation of cloves, which was begun in 1818 and now covers an area of 52,000 acres, with 4,700,000 trees in bearing in the islands of Zanzibar and Pemba. The output averages 6250 tons, heavy crops being produced every 3 or 5 years; the 1918–19 crop was 12,946 t., the largest on record. Coconut cultivation ranks next in importance, and the 48,000 acres planted to this crop could be considerably extended. The copra is badly prepared and compares unfavourably with the Ceylon product; 14,177 t. was exported in 1919. Rubber is obtained from *Landolphia Kirkii*, but there was no crop in 1919; the cultivation of the Ceara rubber tree, attempted unsuccessfully in 1907, has been abandoned. Other crops grown include rice, sugar, areca nut, cassava, chillies, castor plant, kapok, cinnamon, etc. Three soap factories have a combined output of 80 tons a month; the coir fibre, rope and matting industry is found in the coconut districts; and a certain amount of pottery is produced. The value of imports decreased from £2,366,390 in 1918 to £1,934,169 in 1919, and that of the exports increased from £2,133,597 to £2,444,011, cloves and copra being largely responsible for the increment.—(*Col. Rep.—Ann., No.* 1052, *Dec.*, 1920.)

Foreign Trade of the United Kingdom in 1920.—The following statistics show the value of the foreign trade of the United Kingdom in chemicals and related products during the year 1920, based upon the pre-war values of 1913:—

	IMPORTS RETAINED.					EXPORTS OF U.K. PRODUCE				
	Declared Values.		Values in 1920 estimated at average values in 1913.	Percentage excess of average values in 1920 over those of 1913.	Percentage deficiency (—) or excess (+) of quantity in 1920 compared with those of 1913.	Declared Values.		Values in 1920 estimated at average values in 1913.	Percentage excess of average values in 1920 over those of 1913.	Percentage deficiency (—) or excess (+) of quantity in 1920 compared with 1913.
	In 1913.	In 1920.				In 1913.	In 1920.			
	£1,000	£1,000	£1,000	Per cent.	Per cent.	£1,000	£1,000	£1,000	Per cent.	Per cent.
Chemicals, drugs, dyes and colours	11,926	29,959	8,847	238·6	— 25·8	19,533	40,730	13,505	201·6	— 30·8
Oils, fats, and resins, manufactured	13,350	70,516	19,704	257·9	+ 47·6	4,444	13,616	4,445	206·3	+ 0·0
Leather and manufactures thereof	9,501	17,247	4,746	263·4	— 50·0	5,279	11,673	4,632	152·0	— 12·3
Paper and cardboard ..	7,415	29,747	8,067	268·7	+ 8·8	3,679	12,818	3,512	265·0	— 4·5
Earthenware, glass, abrasives, etc.	5,179	10,846	3,178	241·3	— 38·6	7,427	18,324	6,300	190·9	— 15·2
Iron and steel and manufactures thereof	15,551	28,198	7,348	283·8	— 52·7	65,351	128,943	40,207	220·2	— 27·3
Non-ferrous metals and manufactures thereof ..	21,349	31,069	17,952	73·1	— 15·9	12,036	25,868	14,750	75·4	+ 22·5

—(*Bd. of Trade J., Jan.* 27, 1921.)

REVIEWS.

ORGANIC MEDICINAL CHEMICALS. *By* M. BARROWCLIFF *and* FRANCIS H. CARR. *Industrial Chemistry Series, edited by* S. RIDEAL. *Pp.* xvi.+331. *(London: Baillière, Tindall and Cox.* 1920.) *Price* 15*s. net.*

In taking stock of the literature dealing with chemical industry, it is somewhat remarkable that the oldest branch, that relating to the manufacture of drugs, should be so scantily represented. One reason is undoubtedly the fact that the subject is complicated, an immense variety of substances of different classes having to be considered; another, that the operations performed are on a relatively small scale and perhaps hardly appeal so much to the technical man as the larger industries, heavy chemicals, tar distilling, or even the manufacture of dyestuffs. Indeed, when one deals with many of the synthetic drugs, one is forcibly reminded that their economic manufacture should be carried out in conjunction with the dye industry; the very trade-mark "Aspirin" is the property of the Farbenfabriken vormals Friedrich Bayer and Co.

The appearance of the work now under review is all the more welcome since its authors have been successfully associated with some of the largest British works engaged in the manufacture of drugs, whilst their reputation as scientific chemists is such as to guarantee the absence of slavish reprinting of antiquated processes or the unqualified acceptance as gospel of all the statements made in patent specifications.

One paragraph in the authors' preface may well be commended to those engaged in the industry, namely, that relating to the supply of important synthetic chemicals during the war and the lack of economic basis on which such supply was established. In many cases this could not be helped at the time, but now that the war is over and the desire to retain the young industry in the country is a very real one, "it is of outstanding importance to perfect processes so that the most economical methods are used and the best possible yields obtained." If the directors of chemical firms were generally as well-versed in chemical knowledge as the authors, the desirable result would be attained more rapidly.

The Introduction, occupying only six pages, is apt and interesting. The subject matter is divided into sections arranged according to the uses of drugs rather than to their chemical relationships. This division has many advantages, but it cannot always be strictly adhered to, as is apparent when we turn to the natural alkaloids.

Narcotics and General Anæsthetics form the subject matter of the first section. Ether is dealt with at considerable length, and a good account is given of the manufacture as carried out at H.M. Factories at Pembrey and Gretna. Several diagrams illustrate the beautiful Barbet plant which succeeded in giving 94·3 per cent. of the theoretical yield during a period in which over 5000 tons of ether was manufactured. Following ether, we find methylal, paraldehyde, acetophenone and the simpler halogenated aliphatic compounds dealt with, whilst the section concludes with an account of the sulphone hypnotics and urea derivatives such as adalin and veronal.

Section II., dealing with Naturally Occurring Alkaloids and their Derivatives, is illustrated by several diagrams and is followed by Section III., in which an account is given of Natural and Synthetic Local Anæsthetics: one could wish that more than 24 pages could have been spared for an account of the interesting and varied compounds included. Antipyretics and Analgesics follow in Section IV., and here, as in the preceding section, one is struck by the diversity in structure of the compounds used to produce very similar physiological results.

In the case of Organic Antiseptics and Disinfectants (Section V.), phenol, other phenolic compounds and derivatives are taken first. The order followed is rather difficult to understand, for tribromophenol is separated from other phenolic compounds by an account of substances of the type of Chloramine-T: presumably the idea is to keep halogenated compounds together. After formaldehyde and hexamine, certain dyestuffs-antiseptics are dealt with, and the section finishes with the consideration of tannic acid and santalol derivatives.

Purgatives form the subject of Section VI., and Vaso-Constrictors and Vaso-Dilators of Section VII., a considerable amount of attention being paid to synthetic tyramine, histamine and adrenaline. Section VIII., dealing with Diuretics and Uric Acid Solvents, will prove very interesting to many organic chemists even if the subject is not as topical as that of the next section (IX.), viz., Organo-metallic Compounds.

Section X. gives an account of the digitalis group, skin irritants, glucosides and neutral principles, whilst pituitary and thyroid extracts, vitamines and other substances of interest, not finding any other place in the book, are dealt with in the eleventh and concluding section.

In a new edition, one or two rectifications will doubtless be made. On p. 188, Proflavine is described as 3:6-diamino-acridine sulphate, and on p. 190 Acriflavine is oriented 2:6. According to the system adopted in numbering the acridine ring, both should be 3:6 or 2:8, though the latter is now more commonly used. On p. 294, thiosinamin is referred to in brackets as allyl thiocarbamate, whilst the formula given is that of allyl thiocarbamide.

The book is written in an interesting manner and is well indexed; the printing and diagrams are clear; and as a guide to a good general knowledge of organic medicinal chemicals the work may be warmly recommended.

J. T. HEWITT.

THE YEASTS. *By* A. GUILLIERMOND. *Translated and revised by* F. W. TANNER. *Pp.* 424. *(New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.* 1920.) *Price* 33*s. net.*

In 1912 Professor Guilliermond contributed to the Section of Cryptogamic Botany of the *Encyclopédie Scientifique*, edited by Dr. Toulouse, a volume entitled "Les Levures," which forms the basis of the work under review.

So great has been the progress made in the domain of microbiology during recent years that Dr. Tanner of the University of Illinois, who had undertaken the English version, realised that it would be necessary to revise that which had been written, and to add much new matter, in order to produce a book adequate to the needs of those for whom it was originally intended. From the preface one gathers that the translator has been responsible for the revision of the chapters dealing with the physiological side of the subject, whilst the task of the original author has been that of bringing up to date the chapters on Morphology, Phylogeny and Description of Species.

Prof. Guilliermond is so well known for his investigations in this department of mycological science that his name is a sufficient guarantee that the more purely descriptive part of the subject has been dealt with adequately and well, and such will be found to be the case. The author has, in fact, placed all zymotechnologists (it is to be hoped that the exceedingly objectionable word "fermentologist" will not be adopted in this country) under a great debt of gratitude, and his book supplies a want which has been long and widely felt for a complete and descriptive list of the yeasts and associated budding fungi.

The system of classification adopted is that of Hansen, with some modifications and extensions. The family of the *Saccharomycetes* is divided into no less than fourteen genera, together with a number of sub-groups, but some of the points of differentiation are very slight and it is doubtful whether such an elaborate system is, in the present state of our knowledge, really justified.

It may be said here that the invariable use, by the translator, of the word "yeast" as the English equivalent of the more general French term "*levure*" is unfortunate, since it is sometimes used correctly to designate the true *saccharomycetes* and at other times, incorrectly, to cover the whole family of budding fungi, including those which do not form ascospores. This is a serious defect and one liable to produce much confusion in the minds of those whose acquaintance with the subject is limited. To such an extent is the misuse of the word "yeast" carried that in the bibliography a paper by the writer of this review is actually incorrectly quoted, the word "yeasts" having been inexcusably substituted for the word "torulae."

Whilst the descriptive portion of this work leaves little to be desired, the more general portion is very unequal and sometimes very disappointing. The plan is ambitious, but one cannot help feeling that too little care has been devoted to the critical selection of material, and the general impression produced by some of the sections is that of a loosely-constructed dictionary article, rather than that of a carefully thought-out contribution to an important monograph. In the section on the influence of oxygen on fermentation, we are told that Pasteur's conclusions have not been invalidated up to the present, and no reference is made to the work of Adrian Brown either in this section or in that describing the use of the "haemocytometer" (haematimeter). In the bibliographical index, however, Adrian Brown's papers on the subject are included, but under the name-heading: "H. T. Brown"!

A good many glaring mis-statements occur in this portion of the book. Thus, on page 3, we meet the truly amazing statement:—"True yeasts never produce endo- or ascospores," whilst, a few pages later, we read of: "the true yeasts producing endospores." On page 163, the word "estimating" should be "detecting," and on page 124 the substitution of the word "alternation" for "attenuation" destroys the sense of the paragraph.

Making all allowance for transatlantic spelling, the translation leaves much to be desired, and errors of spelling are so frequent, especially in the case of proper names, that attention cannot even be called to all those which have met the writer's eye during a cursory survey of the book. The following, however, may be given as instances:—"Leewenhoek," "Mitscherlick," "Boullinger," "Du Claux," and "Schutzemberger;" and among other instances of careless proof-reading, reference may be made to "galactoce," "hydrogen sulfur," "guaiac," "hydriotic acid" and "ciniferin."

The use of the word "levulose" is etymologically unjustifiable, and the use of the word "scum" for "film" is quite unusual and also less exact. The translator, moreover, uses the word "hydrocarbon" in one whole section, instead of "carbohydrate."

The grammar often leaves much to be desired, and not a few of the sentences are involved and badly expressed.

With all its faults, however, both of omission and commission, the book will be of great value to the fermentation expert, as well as to the student of general mycology. It is because it is likely to be so valuable and because it possesses such excellent features that the reviewer has felt the necessity of calling attention to defects which can easily be remedied in future editions, and which at present detract somewhat seriously from the usefulness of an otherwise admirable publication.

A. Chaston Chapman.

The Chemistry of Enzyme Actions. *By* K. George Falk. *American Chemical Society Monograph Series. Pp.* 136. (*New York: The Chemical Catalog Co.* 1921.) *Price* $2·50.

The unanimous desire of Anglo-Saxon chemists to emancipate themselves from the influence of German chemical literature and its subtle propaganda has caused a good deal of thought and work to be devoted to the development of chemical literature in the English language. In this connexion special reference may be made to the praiseworthy pioneer efforts of Mr. F. W. Atack and his associates, which at least have had the practical result that the question was one of the subjects of discussion at the Inter-Allied Conference of Pure and Applied Chemistry at its meetings in London and Brussels in July, 1919. It was then agreed that the American Chemical Society, which, it may be remarked, is the sole body representing American chemists, should undertake the preparation of scientific and technological monographs.

With commendable celerity, in which one may be allowed, perhaps, to trace the influence of such hustlers as Dr. C. Herty and Dr. C. L. Parsons, the first of these volumes has now been produced in barely eighteen months from the inception of the scheme. The necessary arrangements for publication have been in the hands of certain gentlemen acting as trustees, and, in particular, of William A. Noyes and John Johnston, acting as editors respectively of the two series. The reviews are intended to present the chosen topic in a readable form intelligible to the general chemical reader who may be engaged in other lines of research, and at the same time to stimulate further research in the particular field. They are thus on the same lines as the monographs originated some years ago by Dr. R. H. A. Plimmer in this country and extended under the progressive auspices of Messrs. Longmans, Green and Co. It is generally admitted that the work done by the writers of the British monographs has been of the highest value to their fellow-chemists, and we may expect the same result from the labours of our American colleagues. Chemical science is to-day so vast, and its literature so complex, that no text-book of the old type can deal adequately with it, and it is only by the study of suitable monographs that the advanced student of the present day can gain the necessary all-round acquaintance with his subject. At a time when so much is made of specialisation it is worth while inserting a special plea for the necessity of the widest possible reading of chemical literature, so as to gain a sound knowledge of the subject. No one of us knows at the end of his university career in which particular sections of chemistry his life-work will be planned, and it is only by the broadest possible reading that the necessary critical faculties can be trained.

Dr. Falk's own work on enzyme action is well known and guarantees his competence to inaugurate the series. Broadly speaking, enzymes may be considered from three somewhat different points of view—chemical, biological, or mathematical, using this term to connote, in the author's words, "the better understanding of the fundamental chemical relations underlying an exact knowledge of chemical reactions"; it is mainly on these lines that the review is compiled. Accordingly, the first part of the work deals with the more recent theories of chemical structure, the velocities of chemical reactions and their general theory, before specific reference is made to certain reactions catalysed by enzymes. Sections on the physical and chemical properties of enzymes lead up to a discussion of the chemical nature of certain enzymes and the mechanism of their action. A final section is devoted to their uses and applications. The whole work forms a somewhat abstruse review of present-day physico-chemical theories and will repay the closest study by those interested. It obviously invites criticism in detail, for which this is not an appropriate medium. Sufficient has been said to indicate the scope of the work and to wish the scheme every possible success on behalf of the English-speaking chemists on this side of the Atlantic.

E. F. Armstrong.

OBITUARY.

WILLIAM ODLING.

The death of Professor Odling, at Oxford, on February 17, in his ninety-second year, removes one who was closely associated with the earliest attempts to lay the theoretical foundations of our science. The name of Odling, together with those of his contemporaries, Williamson, Frankland, Kekulé, Berthelot, Wurtz, and others will live in the history of chemistry for his important contributions to the development of the theory of chemical types, which was originated by Gerhardt, who was inspired by Laurent. Odling also contributed a notable paper "On the Natural Groupings of the Elements" (Phil. Mag., 1857), which contained one of the first attempts to classify elements in accordance with "the totality of their characters." His best-known literary work is his translation of Laurent's "Chemical Method: Notation, Classification, and Nomenclature" (1855), but he was also the author of several text-books and lectures at the Royal Institution and elsewhere. His experimental researches related mainly to the composition of simple organic compounds, the ammonia compounds of platinum, the properties of indium, and aluminium compounds. In later years he investigated various potable waters, publishing in 1886, with W. Crookes and C. M. Tidy, a report to the Huddersfield Corporation on the action of water on lead, and serving as one of the analysts of the London water supply. At the banquet given by the Chemical Society, in 1898, to celebrate the jubilee of six of its past-presidents (among whom was Odling), the president (Prof. J. Dewar) remarked that Odling's work "was characterised by precise and clear ideas, and an almost forensic ability for putting things in a straight, concise, and unembarrassing manner."

Odling was born at Southwark in 1829; he studied medicine and graduated at London University, but work with Gerhardt at Paris led him to take up chemistry, and on returning to this country he became demonstrator in chemistry at Guy's Hospital at the age of 21. In 1850 he was appointed lecturer at St. Bartholomew's, and in 1868 succeeded Faraday as Fullerian professor of chemistry at the Royal Institution. Four years later he was appointed Waynflete professor of chemistry at Oxford, in succession to Sir B. Brodie. His connexion with the Chemical Society dated from 1848, and he served it as secretary from 1856 to 1869, and as president in 1873-74. He was made Fellow of the Royal Society in 1859, and doctor of mathematics and physics by the University of Leyden in 1875.

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DANGEROUS DRUGS.

The hubbub which has arisen in connexion with the Dangerous Drugs Act is an example of the futility of allowing lay officials to deal with a highly technical subject, and has been aggravated by contemptuous refusals to accept the advice of competent authorities. The draft Regulations issued by the Home Office for the working of the Act are so impracticable and display such ludicrous ignorance of the actual conditions obtaining in medicine and pharmacy that they have aroused the ire and scorn of medical men, veterinarians, pharmacists, and the general public alike.

The inception of this Act "to regulate the importation, exportation, manufacture, sale, and use of opium and other dangerous drugs" was due to the need of giving effect to the International Opium Convention signed at The Hague in 1912. By the Treaty of Versailles (Article 295) Great Britain was pledged to bring the Convention into operation within twelve months of the coming into force of the Treaty. There was no serious opposition to the passing of the Act, the principle being accepted by all concerned as wholesome legislation. In the Committee stages of the Bill in the House of Commons several alterations were made mainly as a result of the informed criticism of Mr. W. J. Uglow Woolcock, general manager of the Association of British Chemical Manufacturers, who was formerly secretary to the Pharmaceutical Society, and able to speak with authority

The Act eventually came into force on September 1, 1920, and besides restricting or prohibiting (except under licence) the import and export of raw opium, prepared opium, and cocaine, it controlled the manufacture, use, and distribution of cocaine, morphine, ecgonine and diamorphine (heroin), and of preparations containing any of these. The real trouble began with the issue, early in January, of the draft Regulations. These were so drawn as to make it illegal to sell without a doctor's prescription such ordinary household remedies as cough mixtures (containing morphine or heroin in medicinal quantities), chlorodyne (containing morphine), or even gall-and-opium ointment. Twenty-five official preparations in the British Pharmacopœia are thus prohibited, as well as hundreds of unofficial preparations at present in daily use. The Regulations go far beyond the requirements of the International Opium Convention, which expressly recognised existing laws and regulations and laid down that nothing should "apply necessarily to medical prescriptions and to sales made by duly authorised pharmacists." The retail sale of all the drugs mentioned in the Dangerous Drugs Act is already subject to very strict control by qualified pharmacists under the Poisons and Pharmacy Acts. In addition to previously existing restrictions, however (of which the official draftsmen were apparently entirely ignorant), these Regulations provide for five separate books to be kept by pharmacists and four by doctors or veterinary surgeons, in which records of sales, etc., have to be kept.

Pharmacists were promptly up in arms as soon as the Regulations were issued, and when it dawned upon the medical profession that a policeman might enter a doctor's surgery and overhaul his stock of morphine preparations, etc., in a vain endeavour to trace the whereabouts of a minim of hypodermic solution of morphine, and that every doctor would have to keep a separate record of each issue of morphine, cocaine, opium, and diamorphine the medical temper likewise began to rise. Furthermore, when it was discovered that no farmer or stock-owner could keep a colic draught for his cattle, that no householder could store laudanum, Dover's powder, or gall-and-opium ointment in his medicine cupboard, the outcry against this inept Departmental legislation developed to such an extent that it has induced a gradual and progressive "climbing down" on the part of officialdom. What the ultimate result will be it is difficult to gauge, but the situation at present is that the Home Office autocrats in charge have turned down the commonsense suggestion that the Regulations should be referred to a committee of medical and pharmaceutical experts for consideration as a whole.

VITAMINS AND THE FOOD SUPPLY.

A. HARDEN.

It is now well recognised that a satisfactory diet must not only contain a sufficient supply of energy along with a provision of protein and mineral substances, suitable both qualitatively and quantitatively for the needs of the organism, but that it must also furnish certain hitherto unidentified accessory factors, the so-called vitamins, required, it is true, only in minute quantity, but indispensable for growth and proper maintenance. Three of these principles have so far been differentiated, and these are most conveniently termed, adopting Drummond's modification of Funk's nomenclature, vitamins A, B and C. The evidence on which the belief in the existence of these three essential dietary factors is based is by this time familiar and can be found in many quarters (see especially Report of the Committee on Accessory Food Factors, Special Report Series No. 38, M.R. Council, and Physiological and National Needs, Constable).

Two important points must, however, be borne in mind throughout any discussion of the vitamin question. *First*, that the mammalian organism is unable to synthesise these principles for itself and is entirely dependent for its supply on the food with which it is nourished; *second*, that the young growing organism requires a relatively greater supply of them than the adult. It must further be remembered that the offspring is in its early stages entirely dependent for its nutrition upon the mother, who has therefore to receive a supply of vitamins adequate for the needs both of herself and her young.

The distribution of these factors among the common articles of diet of man and the domestic animals is being gradually worked out and is already known in its general qualitative relationships, but requires a large amount of further quantitative investigation. The table overleaf will serve to remind the reader of the specific importance of each of the vitamins and to give a rough idea of the kind of food material in which it may be expected to be found.

Vitamin Requirements.

When we come to consider the vitaminic requirements of an average individual we have to confess to a lamentable lack of accurate information. We are, indeed, in a better position with regard to many of the lower animals, for it has become possible to ascertain with some degree of accuracy by direct experiment the amount of milk or orange juice necessary to protect a guinea pig or a monkey from scurvy, or the amount of yeast which will perform a similar function for a rat or pigeon with regard to polyneuritis. One important conclusion which has been definitely ascertained in this respect is that different animals, even although closely related, vary very considerably in their need for vitamins. A striking instance is afforded by the guinea pig and the rat, both rodents, in relation to the antiscorbutic vitamin. The guinea pig is very sensitive to lack of this principle and on a scorbutic diet rapidly shows symptoms of scurvy and finally dies of the disease. The rat on a similar diet shows scarcely any sign of the absence of the principle, grows to a good weight and produces young. Careful examination has, indeed, revealed a certain inferiority in the scorbutically fed animals, but scurvy never develops. A less extreme difference is shown by a comparison of the antiscorbutic needs of the guinea pig and the monkey, animals which are both affected by scurvy. The latter, of about ten times the weight of the former, requires almost exactly the same amount of antiscorbutic (orange juice or milk) to protect it from scurvy.

With regard to human requirements we are compelled to turn to a consideration of the actual diets which have been found to keep us in health and draw what conclusions we can from an analysis of these. Except in the case of the very young, these diets are generally of a mixed and varied character so that accurate deductions are difficult. Reference to the table will show which constituent of the daily diet must in most cases be the source of each of the vitamins. As regards the child we are in a somewhat better position. The antiscorbutic requirements (as well as those of vitamins A and B) of a child of 5—7 kilos. are usually considered to be met by a diet of about 500 c.c. of cow's milk. Although, as we shall see, milk is itself a variable quantity, and the above amount is not strictly a minimum, this affords a basis for a rough comparison with the monkey and guinea pig, which both require 100 c.c. of milk daily.

Variation in the Vitamin Content of Foodstuffs.

It is almost certain that the amount of vitamin contained in natural foodstuffs is not a constant quantity, but varies under different conditions of season, age, and so forth. Very little accurate work has yet been done in this direction, but indications have been observed, for example, that the antiscorbutic potency of grass is greater in the young than in the more mature growth. An extreme case is afforded by the well-known production of the antiscorbutic vitamin during the germination of seeds, which themselves contain none, or very little, of this principle.

When we come to deal with secondary foodstuffs—derived from animal sources—a further complication arises, which is well illustrated by the case of milk. The vitamins of the tissues of the animal which is secreting milk are all derived from the foodstuffs of the diet. If these are varied so that very little vitamin is supplied in them several possibilities arise. The supply of milk may be kept up but its vitamin content may be diminished, so that the young suffer, or the vitamin content may be maintained for some time at the expense of the tissues of the mother. On the other hand, the difficulty may be met by a smaller secretion of a milk of the original quality. Here, again, the experimental observations are not conclusive. Hopkins, at Cambridge, found that the fat-soluble factor (vitamin A) of goat's milk remained approximately constant when the animal was given a diet deficient in that respect, but that the quantity yielded fell off. On the other hand, in America, several investigators

Table I.

	Vitamin A.	Vitamin B.	Vitamin C.
Synonyms	Fat-soluble A	Water-soluble B Anti-neuritic	Water-soluble C Anti-scorbutic
Effect of deficiency..	Retarded growth ending in death Eye-disease (Keratomalacia) Probably one factor in causation of rickets	Retarded growth ending in death Beri-beri Polyneuritis of birds, rats, etc.	Scurvy
Chief sources ..	Animal fats Fish liver oils Green vegetables Egg-yolk Butter and milk Oleo-margarine, in proportion to animal fat.	Seeds, particularly in the germ, pericarp and aleurone layer Yeast Egg yolk	Green vegetables (especially *Cruciferae*) Orange and lemon juice Tomatoes Germinated seeds Swedes and turnips
Present in smaller amounts.	Oil-seeds Carrots	Meat Milk Potatoes and some other tubers and roots Green vegetables Some fruit juices	Meat Milk Potatoes and some other tubers and roots Many fruit juices Dried vegetables
Absent from ..	Most vegetable oils Most lard Most margarine White bread Egg white Yeast Purified proteins and carbohydrates	White bread Polished rice Fats Egg white Purified proteins and carbohydrates	Seeds White bread Fats Yeast Purified proteins and carbohydrates

working with cows found only a small diminution in the milk flow, but a large depreciation in the antiscorbutic potency of the milk, when the cows were given a diet deficient in vitamin C. Indications have, moreover, been frequently observed of the antiscorbutic inferiority of winter to summer milk, and the winter feed given to cattle in this country is frequently very deficient in both vitamins A and C. At this point laboratory investigations come into close contact with practice, and it should not be difficult to devise a winter feed for cattle which would ensure a supply of milk containing as much of the various vitamins as that produced during the summer. Precisely similar conditions hold for human mothers, and there seems little doubt that lack of sufficient vitamin in the diet of expectant and nursing mothers is often responsible for ill-health or positive disease in their children, such as rickets and scurvy—obvious or incipient—with all their evil and lasting results. It is, moreover, obvious that the vitamin content of many important foodstuffs, such as butter, meat, animal fats, etc., must be dependent on the diet of the animals from which they are derived.

Influence of Processes of Manufacture or Preparation.

We have so far considered foodstuffs in their natural state, but to the variations inherent in the nature of the different food materials or due to modifications of the diet of animals, must be added those brought about by the treatment which many foodstuffs receive before they reach the consumer.

Milling of Grain.—The classical example of this is the milling of grain (rice, wheat), in which the germ, or embryo, which contains by far the greater part of the vitamin B and most of the pericarp and aleurone layer, which contain the rest, is removed. As is now well known, the unbalanced use of milled rice leads to beri-beri, and is the main cause of that disease in the tropics In the same way the British soldiers during the siege of Kut suffered from beri-beri on account of the lack of vitamin B in their diet of white bread and meat, whereas the Indian troops escaped this scourge because their ration included a kind of lentil (rich in vitamin B), and their bread was made from a less "perfectly" milled grain. It is interesting to note, in passing, that as regards scurvy the conditions were reversed. In the total absence of raw vegetables and fruits the British were protected by their large ration of horseflesh; the Indians, who refused to eat meat, went down with a scurvy.

Desiccation.—The effect of drying varies very greatly with the nature of the food material. Cabbage, the richest known source of the antiscorbutic vitamin, when dried, even at a low temperature, loses 70 to 80 per cent. of its antiscorbutic potency, and similar results are given by many other vegetables. On the other hand, fruit juices (orange, lemon) can be evaporated *in vacuo* with little or no loss. About milk some uncertainty prevails. Fresh cow's milk is a very poor antiscorbutic, of only about 1 per cent. the value of raw cabbage, and, moreover, as has been already emphasised, varies in character with the diet of the cow. The potency of dried milk depends in the first instance on the process employed for drying, and there seems little doubt that if undue exposure to a high temperature (and possibly to aeration) is avoided, dried milks can be prepared not greatly inferior in antiscorbutic potency to fresh milk. On the other hand, it has been definitely proved by experiments with monkeys (and guinea pigs) that many samples of dried milk actually put on the market contain much less of the antiscorbutic principle than fresh milk. So markedly is this the case in some instances that an animal which has acquired scurvy on a certain ration of dried milk has been cured by an equal ration of fresh milk. Vitamins A and B, on the other hand, are comparatively less affected by desiccation, although here, again, the effect varies with the nature of the foodstuff. Thus, milk appears to suffer very little loss in either of these respects on drying, whereas cabbage loses a large part of its vitamin A on drying, although not so high a proportion as of the antiscorbutic.

Preservation.—Comparatively little is known of the effect of preservation on the vitamin content of food materials. The most accurate information available concerns the antiscorbutic factor. Dried cabbage has been carefully tested in this respect by Holst, who has found that when it is air-dried and preserved over phosphorus pentoxide the antiscorbutic potency (which, it must be remembered, is only a small fraction of that of fresh cabbage) is retained even at 37° C. for long periods. When preserved over calcium chloride, however, it rapidly deteriorates, and more rapidly as the temperature at which it is preserved is raised. Dried orange juice, too, has been found to retain its potency over considerable periods, and it seems probable that a perfectly dry powder will withstand preservation at ordinary temperatures for a long time, whereas in the presence of even very small amounts of moisture deterioration will occur. Lemon juice under ordinary conditions rapidly deteriorates, but in presence of the natural antiseptic provided by the oil of the rind has been kept for as long as two years at ordinary temperature, whereas at 37° C. in the same time it became quite inactive.

Heat.—The action of heat on the vitamin content of foodstuffs is, of course, of fundamental importance, since many of the processes of food preparation and preservation involve the application of heat at some stage. The experimental investigation of the question has been complicated by the fact, which at first escaped observation, that certainly in the case of the fat-soluble vitamin A, and probably in that of the antiscorbutic C, aeration plays an important part as well as rise of temperature. It has so far been found that vitamin A is moderately stable towards rise of temperature, provided that the presence of air is avoided, whereas in the presence of air it is rapidly inactivated even at comparatively low temperatures. Thus, butter-fat heated at 120° C. in an autoclave for four hours was found still to contain abundance of vitamin A, whereas when it was simultaneously aerated by a current of air it lost the whole of its potency in the same time. This loss on aeration has also been found to occur in six hours at as low a temperature as 50° C. Cabbage retains practically the whole of its vitamin A on cooking, and milk, like butter, can be autoclaved at 120° for an hour without its value in this respect being perceptibly impaired. With regard to the antiscorbutic vitamin, matters are not quite so clear. The effect of heat seems to depend largely on the nature of the material in which the vitamin occurs. Thus, cabbage juice rapidly loses a large proportion (about 85 per cent. of its potency) when heated for an hour at 100° C., whereas swede juice only loses 50 per cent., and orange juice (even when neutralised) is unaffected under the same conditions. Whether aeration is concerned is not yet definitely settled. In milk the antiscorbutic vitamin is certainly less stable than vitamin A, since autoclaved milk is free from antiscorbutic, but contains a considerable amount of vitamin A. Vitamin B (the antineuritic) must be regarded as moderately stable towards rise of temperature, since it has been found to be little affected by heating for 1—2 hours at 100° C. (wheat embryo, yeast extract), and has even been known to survive boiling with sulphuric acid (Funk).

The practical conclusion as regards processes of sterilisation is that at present it is unsafe to dogmatise, particularly with regard to the antiscorbutic vitamin, so that each new case really requires special investigation. It is already known, for example, that the process of canning largely destroys the antiscorbutic value of green vegetables, whereas canned tomatoes retain a large part of the high activity of the fresh fruit.

Oils and Fats.—Particular interest attaches to the presence of vitamin A in oils and fats because these are constituents of all diets and, moreover, form in many cases the chief, if not the only, source of this vitamin. Almost all animal fats have been found to contain this substance, the striking exception being lard. As this question has recently been brought before this Society by Drs. Drummond and Zilva, it will suffice to state that this exceptional deficiency has been found by them to be in part due to the processes of extraction and refinement and in part to the peculiar relation of the pig to this vitamin. Fish oils are very rich in vitamin A, but it is thought that much is lost in the processes of refining. Hydrogenation absolutely destroys this vitamin, hydrogenated whale oil, for example, being absolutely devoid of it, whereas the natural oil is rich in it. Whether this is due to the actual reduction, to the catalyst, or to the conditions prevailing during the treatment is not yet known.

The vegetable oils form a problem of great importance in this respect. Most of the oil-seeds contain more or less of the vitamin, whereas many of the vegetable oils as placed on the market, and used for the preparation of margarine, are devoid of it. Whether this is due to the small proportion present in the original seed, to the process of extraction or to the subsequent treatment of the oil is not definitely known. Further investigation is urgently called for to settle these important questions. Much has been already done at the initiative of the manufacturers, and thanks to the wise liberality of the Medical Research Council, which has devoted large sums to the support of investigations on the vitamins, steps are now being taken to make a systematic study of this subject, which has so vital a bearing on the health of the population in general and of the child population in particular.

FILTRATION BY ROTARY VACUUM-FILTER.

F. BLOOR.

At the Conference on Filtration held last July by the Chemical Engineering Group little attention appears to have been given to filtration by rotary vacuum-filters, although one would gather from the remarks of E. Hatschek (*cf.* J., 1920, 227 T) that, owing to the accessibility of the cake, whereby both washing and removal are facilitated, and the fact that the filtering process can be made continuous, the method would be one in fairly general use in the chemical industry. However, except for a few products, such as soda ash, produced on a large scale, and its use for extracting salt from ammonium sulphate, the rotary vacuum-filter seems to find little favour at present among technical chemists.

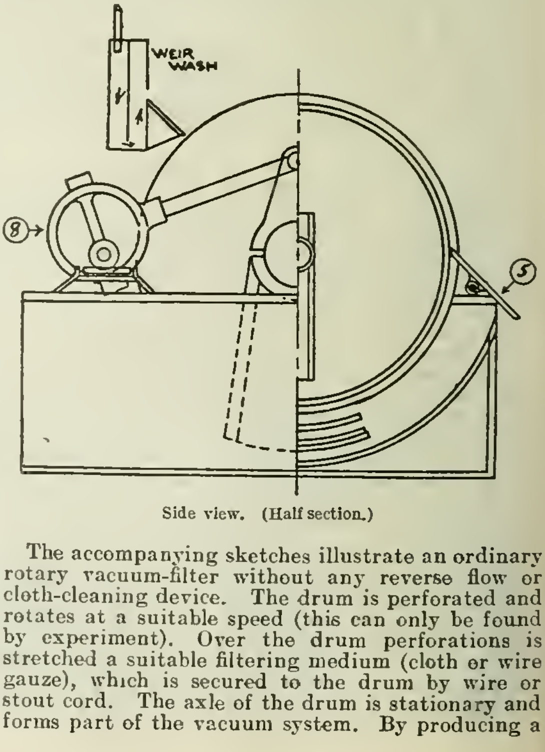
In a recent issue of the *Chemical Trade Journal* (Vol. LXVII., p. 741) a chemical manufacturer writes:—"I have cut my filtration costs down from £3 to 1s. 9d. per ton by the use of continuous automatic filters." Although the type of filter is not stated, the inference to be drawn is that the enormous saving in labour costs has been brought about by the substitution of a continuous filter (such as the rotary vacuum-filter) for a neutch or filter press. It is the possibility of this saving in labour charges and the belief that objections to this type of filter are ill-founded which induce the writer to advocate its more extensive use.

As illustrating the low labour costs which are possible with a rotary filter, one may instance the case of a filter with a drum 6 ft. in diameter by 3 ft. 4 in. wide discharging 6 to 8 tons of soda ash per hour at a labour cost of less than 6d. per ton; moreover, for this cost the material is deposited (by a belt-conveyor) at any desired spot. The question for the chemical manufacturer is, however, whether this type of machine can fulfil the necessary filtering desiderata when dealing with products that differ from soda ash (for instance, in the filtering and washing of sludges, amorphous substances, dyestuff-intermediates, as well as dyestuffs themselves), and can give better results at less cost than neutches or filter presses. In the opinion of the writer this type of filter can be made to deal efficiently with substances of the kind mentioned.

The superiority of the rotary vacuum-filter over other types of filter can obviously only be demonstrated by actual filtration tests on the products concerned, and after comparing filter capacities, costs, efficiencies (washing, etc.). The writer has carried out a few tests with this object in view, but the filter was the ordinary type (described below) without the improvements suggested. However, by measuring the thickness of cake which could be built up and the speed of rotation, it was possible to estimate fairly accurately what a suitably designed rotary filter could do.

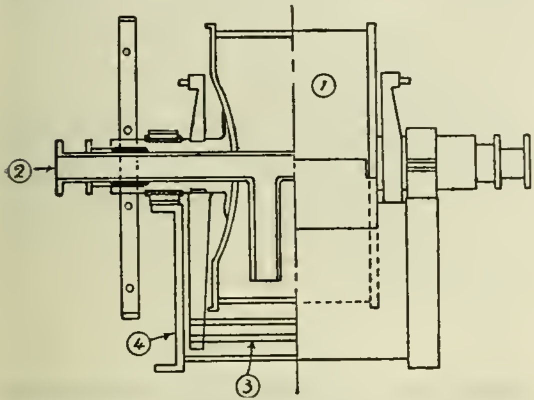
The following are actual examples of two very dissimilar products:—(1) A light crystalline substance; cake built up ½ in. thick, drum rotating 1½ revolutions per minute. (2) Sludge (very sticky); cake built up ⅛ to 3/16 in. thick, drum rotating 1 revolution per minute. This cake gives great trouble in washing in a wash-press, but was washed efficiently on the rotary filter.

With a filter of the size already indicated it should therefore be possible to filter and wash products similar in nature to the first at the rate of 5 to 6 tons an hour, whereas with sticky material the rate would of course be much slower. The rate for a sludge (which is a difficult substance to filter) would be about one ton per hour.

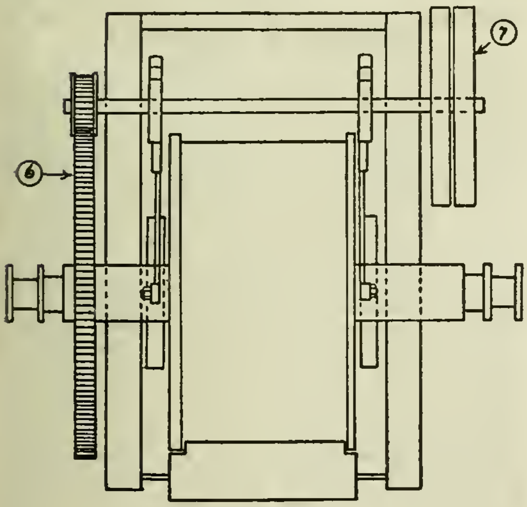


Side view. (Half section.)

The accompanying sketches illustrate an ordinary rotary vacuum-filter without any reverse flow or cloth-cleaning device. The drum is perforated and rotates at a suitable speed (this can only be found by experiment). Over the drum perforations is stretched a suitable filtering medium (cloth or wire gauze), which is secured to the drum by wire or stout cord. The axle of the drum is stationary and forms part of the vacuum system. By producing a vacuum on the inside of the cloth, which is immersed in the reservoir, liquor is drawn through the filtering medium, leaving a film of solid on the cloth. When the drum is rotating this layer of solid can be washed with a suitable solvent (the washings being kept isolated from the filtrate, if necessary). It will be evident that this type of filter lends itself to the use of mechanical devices for drying or steaming the cake and also for dealing with fumes. Where the drum passes the "doctor," or knife, the solid is scraped off, and should then be in a form very suitable for handling at little cost.



Front view. (Half section.)



Plan.

Rotary Vacuum Filter.

Key.

1. Perforated Drum.
2. Vacuum Pump.
3. Agitator.
4. Trough.
5. Knife.
6. Gearing.
7. Pulley.
8. Eccentric (to operate agitator.)

It requires very little knowledge of filtration to see that the whole success of the filter depends on maintaining the cloth clean; otherwise the rate of filtering will slow down to such an extent as to make the method valueless. In the case of a crystalline body like soda ash the "doctor" is clear of the cloth by about $\frac{3}{16}$ in., so that the cloth requires cleaning before it enters the liquid. This is easily accomplished by causing a portion of the filtrate to pass through the cloth again (usually termed a reverse flow). The filter will run continuously for days with very little attention, but with sludges (*e.g.*, from limed-out sulphonations) the problem is more difficult and cannot be solved as easily as for soda ash. The layer of sludge collecting on the cloth will be very thin ($\frac{1}{8}$ to $\frac{1}{4}$ in.), and the "doctor" and drum must be adjusted so accurately that practically all the solid can be scraped off without injury to the cloth. In addition, a very efficient cloth-cleaning device should be used, and the writer suggests that this is best achieved by designing the drum of the filter so as to leave the binding-wire or cord flush with the filtering medium, and providing an internal pressure chamber (designed for varying pressures of air or liquid) to keep the pores of the cloth clean. The absence of these last two factors has caused the rotary filter to be condemned as unsuitable for dealing with such materials as sludges and other products from chemical and dyestuffs factories.

Apart from the question of low labour costs, there is no doubt that the maintenance cost (filter cloths, repairs to power services, etc.) will be lower for a rotary vacuum-filter than for filter presses using compressed air and hand-scraped cloths. However, each filtering process is a problem in itself, and the best and most economical results can only be achieved by experimenting with all the available types of plant. In the past it is doubtful whether chemical manufacturers have given to the rotary vacuum-filter the consideration that its merits deserve.

AN INTERESTING FIRE IN A LABORATORY.

T. HOWARD BUTLER.

The following account of a fire, which took place in the laboratory of Messrs. Wm. Butler and Co. (Bristol), Ltd., will no doubt be of interest to members of the Society, as the circumstances were extraordinary, and may be of use as a warning to other chemists.

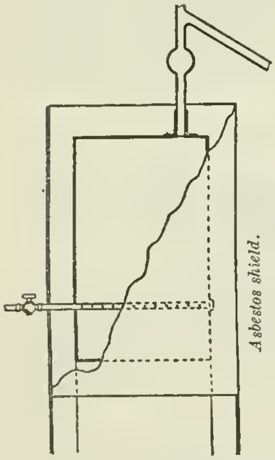
The diagram shows the apparatus that was employed for distilling coal-tar creosote oil. The still is the one recommended by the Ministry of Munitions, and used during the war by its advisors, Dr. H. G. Colman and Dr. P. E. Spielmann, for estimating the amount of benzene and toluene in tar. It will be noticed that the iron still is heated by means of a ring burner which completely surrounds the still, and which may be moved up or down as desired with the object of facilitating the distillation of a watery tar.

In the distillation in question the still contained about 0·75 gall. of creosote, to which had been added 200 c.c. of a heavy naphtha to facilitate distillation of the small quantity of water in the original creosote. The object of the distillation was to obtain a fraction of creosote oil distilling within a certain range of temperature.

The distillation had been carried out with the ring burner placed about three inches from the bottom of the still, and apparently all the water and naphtha had been removed, as the distillation had ceased. The flame of the ring burner had not been raised, and the contents of the still were "sweating," as it was desired to be sure that all the water had been distilled off. This "sweating" had been going on for some time, approximately one hour, and the temperature of the vapour at the top of the still during this time was 210° C., which indicated that the temperature of the liquid in the proximity of the burner was probably about 250° C.

At the time of the accident, fortunately, no person was in this laboratory, and the first indication of any trouble was given by a chemist who was passing the door and saw that the still was "bolting over." This person warned the chemist who was in charge of the distillation, and before either could get into the room, an increasing hissing noise, that can only be described as like a roaring wind, was heard. Both chemists rushed towards the room, which is about 21 ft. long, by 12 ft. broad, by 12 ft. high, and found it completely full of a thick black cloud.

Fortunately this laboratory was fitted with a stop-cock on the gas-main outside the room itself. This was immediately turned off, but there was a small quantity of creosote in a tray in the near vicinity of the still on fire. They removed this, together with some smouldering papers which were on the table in the centre of the laboratory. As the room was completely filled with this black smoke, and all apparent danger had ceased, the laboratory was left for several hours until the carbon had settled. The heat of the combustion or slow explosion, whichever it may be termed, was distinctly felt in the adjoining laboratory, although no serious concussion, beyond the already described "rushing wind" sound, was noticed.



Still, 6in. diam., 1ft. high.
Capacity, about 1 gall.
Charge, ¾ gall.
Burner at time of explosion, 3in. from bottom.
Charge about 5in. from top.

The room was carefully examined the following day, and it was found that intense heat must have been developed during the accident, as a small part of the lead bench had been melted, and paint on the shelves and beams supporting the ceiling was badly blistered, also note books, papers, and similar articles lying on the table in the centre of the laboratory were completely charred; in fact, the appearance of the laboratory the next day gave the impression that a fire had been burning in the room for some considerable time; as a matter of fact, the actual fire lasted only some few seconds.

An interesting feature of the occurrence was that within two yards of the still there was a bottle containing about 100 c.c. of ether which remained unaffected.

It is not easy to determine definitely the cause of the accident, but it is probable that during the "sweating" process the top portion of the liquid became heated to a fairly high temperature, and that probably there was one or perhaps more drops of water condensed on the top of the still, which fell into this heated liquid and caused the "bolting." This may have become so violent that the cork was blown out of the still and ebullition again increased until there was a considerable cloud of creosote vapour above and around the still; and then this vapour was fired by the flame from the ring burner. It is conceivable that the cloud was in a condition of part vapour and part spray, and that when it caught fire it burned so rapidly that what might be termed a slow explosion ensued.

As the lessons that can be drawn from such an accident are of great value for future precautions, it may be of interest to observe that there is always a danger in heating any vessel to a comparatively high temperature at a point other than the bottom, unless the bottom be also heated; and in this case it seems probable that the accident would not have occurred if a small flame had been playing on the bottom of the still. This would have ensured the whole of the contents of the still being at one temperature. The superheating would probably not have been serious if the ring burner had been set nearer the bottom of the still. It is doubtful if "sweating" should be prolonged for any length of time; if the creosote had been heated more rapidly, immediately after the water had been distilled over, the rush of vapour would probably have brought over any small quantity of water that had condensed on the top of the still. Again, a ring burner should not be used without bottom heating, and it should be rapidly lowered to near the bottom of the still by the time that there are indications that all the water has been distilled over.

The above explanation and the conclusions drawn from it are put forward tentatively in the hope that others who have experienced similar accidents will also communicate their observations and inferences to this Journal.

SOCIETY OF CHEMICAL INDUSTRY.

JOINT MEETING WITH THE INSTITUTION OF MECHANICAL ENGINEERS.

A special meeting of the Society was held conjointly with the Institution of Mechanical Engineers—the first, it is to be hoped, of a series of similar meetings—at the Institution, Storey's Gate, S.W. 1, on March 4, when Monsieur Paul Kestner read a paper on "The De-gassing and Purification of Boiler Feed-Water." Capt. Riall Sankey, president of the Institution, was in the chair, and he was supported by Sir William Pope and other representatives of the two societies.

In the process continuous blowing-down of the boilers is combined with hot purification of the make-up feed water. The blow-down water is passed through a feed-water heater, the mud and separated salts are retained in a trap, and the purified blow-down water is returned to the boiler. When the feed-water, containing sodium carbonate and bicarbonate, gets into the boiler, the bicarbonate is decomposed and the carbonate partially hydrolysed, so that hydroxide, as well as carbonate, is used to purify the feed-water. The Kestner apparatus comprises a steam-separator, and a heater having a central reservoir to receive the blow-down liquid, and an annular vessel surrounding the reservoir, into which the purified blow-down water is decanted. The feed-water, preheated by the steam, mixes with the blow-down liquid as it leaves the reservoir, a measured amount of soda having been previously added, and precipitation and settlement take place in the annular chamber.

Dissolved oxygen is removed by means of cast iron containing 0·7 per cent. of manganese, which acts as a catalyst. The hydrated ferric oxide formed is reduced to the ferrous state on being left in contact with the unchanged iron, and the ferrous compound is available for further de-gassing. In the apparatus employed the water flows alternately through two vessels each initially filled with iron turnings, or it passes up and down a single vessel similarly charged and with filters at each end, the direction of flow being changed by a valve-arrangement, thus allowing the material to recuperate.

NEWS FROM THE SECTIONS.

GLASGOW.

A meeting of this Section was held in the Institute of Engineers and Shipbuilders, Glasgow, on February 1. Mr. J. H. Young occupied the chair, and Mr. J. G. Roberts read a paper on "Colloids in Clays: A Criticism."

The author gave a brief account of the better known colloids, typical suspensoids, and emulsoids of the silicic acid type. He described the composition and character of china clay, and contrasted its "colloidal" properties and those of other purer clays with silicic acid and alumina gels. The contradictory nature of many of the statements in Searle's paper on "Colloids in Clay" contained in the third Report on Colloid Chemistry were pointed out and discussed, and also the apparent confusion between the colloid and amorphous conditions. The liquefaction of clay suspensions was demonstrated, and also electro-osmosis or cataphoresis of a suspension of fine clay. Fired samples of some electrically-separated clays were also shown.

EDINBURGH AND EAST OF SCOTLAND.

At a meeting held on February 15 Dr. D. S. Jerdan in the chair, a paper was read by Mr. W. N. Stokoe, entitled "Investigations on the Rancidity of Margarine and Butter Fats."

After referring to the chemical changes possibly occurring in rancid fats, the author discussed the chief causes of rancidity, which in commercial oils are the action of air, light and moisture, and lipolytic enzymes. Rancidity in butter and margarine is caused by the action of micro-organisms which find in the substances suitable media for their growth and propagation.

Mr. Stokoe classified the various forms of rancidity under the divisions of appearance, odour, and taste, and showed lantern slides of the micro-organisms associated with each form. A particular kind of rancidity, which he termed the "perfume" form, occurs only in those margarines containing coconut and palm-kernel oils, and is caused by enzymes secreted by such moulds as *Penicillium glaucum* and species of *Aspergillus*. The substance giving rise to the perfume consists chiefly of methylnonyl ketone accompanied by other ketones. Other forms of rancidity were discussed and specimens of rancid fats exhibited.

The various sources of contamination by micro-organisms during the manufacture of butter and margarine were examined, and great emphasis was laid on the necessity for thorough cleanliness in manufacturing processes. The practice of transporting and storing oils and fats in wooden containers is utterly wrong, as it is impossible to sterilise the wood properly, and the canvas put on the bungs of barrels is a fruitful source of mould spores. The paper used for wrapping margarine also gives rise to contamination by micro-organisms, and the author described various methods of sterilising wrapping paper.

NEWCASTLE.

Two papers were read at the meeting held in Armstrong College on February 16, Dr. J. H. Paterson presiding, both of which described work carried out in the Agricultural Chemistry Laboratory of the College.

Dr. A. A. Hall described "A Quick Volumetric Method for the Estimation of Mercury," which is applicable to soluble mercuric salts either in the presence of acid or of any substance unaffected by caustic soda solution, and can also be used in the presence of soluble copper salts and ammonium salts. An excess of an ammonium salt and then an excess of the standard alkali is added to a known volume of the mercuric solution, and the "white precipitate" formed is made up to a known volume with water and filtered through a dry filter. An aliquot part of the filtrate is titrated with standard acid in presence of methyl orange, and the difference between the amounts of alkali and acid used represents the amount of alkali consumed in precipitating the mercury. If acid be present it can be estimated by titration with alkali before the excess of alkali is added. If the solution contains copper the deep-blue solution formed gradually fades as the liquid becomes neutralised. The author adduced analytical results which indicated the accuracy of the method under the various conditions mentioned.

In a paper on "Fractional Distillation Columns," Mr. S. Hoare Collins described a short fractionating column about 30 cm. long from bottom to side tube and 18 cm. diameter with an extension tube 90 cm. long of the same diameter. Both are filled with glass spirals made by winding heated glass rod of 5 mm. diameter round a central rod of 6 cm. diameter. Experiments conducted with a mixture of benzene and toluene showed that such a spiral gave far better results than a "rod and disc" filling.

MANCHESTER.

The sixth meeting of the session was held at the Textile Institute on March 4, Mr. Allan presiding. About fifty members were present and two papers were read. The first, on "Column Apparatus for the Chemical Industry," read by Mr. S. J. Tungay, set out the conditions to be observed in the design and construction of column apparatus, and emphasised the point that faulty working was in most cases due to disregard of the fundamental actions required to take place in the columns; as an instance it was mentioned that counter currents may mix or may not. The paper contained descriptions of many types of column apparatus. The second paper, on "Normal Amyl Benzene and some of its Derivatives," by Messrs. L. G. Radcliffe and N. Simpkin, was read by the former, and described investigations made to find uses for butyl alcohol now being produced in large quantity. The production of a mono-sulphonic-acid phenol and a para nitro-compound was described.

MEETINGS OF OTHER SOCIETIES.

THE INSTITUTE OF CHEMISTRY.

The forty-third annual general meeting was held on March 1 at Russell Square, W.C. Sir Herbert Jackson, the retiring president, in his address remarked that Government departments and official authorities generally had of late extended greater recognition to the services of men of science than in the past. The conditions of appointment of chemists, both in the Government service and in industry, had been improved, and until the close of 1920 very few members of the Institute were disengaged. The prevailing depression in industry had, however, affected the employment of chemists, but even now less than 50 were disengaged out of nearly 3300 on the roll. The by-laws of the Institute had been revised to provide for the representation of chemists from various parts of the country and practising in different departments of work, to define more specifically certain points relating to the ethics of the profession, and to restrict the membership of the Institute to British subjects. The Institute was taking part in many matters affecting the public life of the country where chemistry was concerned, and the annual report showed that chartered professional bodies of this character were able to render valuable service to the State. It was probably desirable at the present moment for the Council of the Institute, without taking part in politics, to express its views on the grave importance of maintaining in this country industries on which not only the future development of our chemical industry and many allied industries depends, but the future of a very large number of students of chemistry who are now being trained. The Institute was entrusted by its charter to secure the supply of well-trained chemists, but unless a great chemical industry was maintained their prospects would be very poor. The president maintained that the Institute had throughout its existence fulfilled the purposes for which it was incorporated. It had kept alive the corporate spirit of the profession; it was the officially recognised public body to which the country could turn for advice and guidance on matters relating to the profession; it assisted those who intended to follow the profession of chemistry, and promoted and maintained the highest standard of training and competence for that profession; it registered the trained and competent, and it fostered the strictest integrity on the part of its members in their dealings with one another and with the public. He was confident that it would continue to gain strength and prestige.

SOCIETY OF PUBLIC ANALYSTS.

An ordinary meeting was held at the Chemical Society's Rooms on March 2, Mr. A. Smetham presiding.

A paper on "The Acidity of Ink and the Action of Bottle Glass on Ink" was read by Mr. C. A. Mitchell, who explained why acid was added to ink, gave the amount present in standard inks, and described acid-free inks, the estimation of acidity, and the difficulty caused by the presence of dyestuffs. The uses and limitations of the hydrogen-peroxide method and the estimation of total acidity as a check on the manufacturing process were dealt with and the effects of glass on ink discussed.

In a paper on "The Detection of Adulteration in Butter by means of the Melting-point of the Insoluble Volatile Acids," Mr. G. van B. Gilmour described how the addition of small amounts of coconut and palm-kernel fats to butter appreciably lowers the melting-point of the insoluble volatile acids. Tables of melting-points and distillation-figures for pure fats and mixtures were given, and also graphs showing how the melting-point is affected by adding increasing quantities of coconut and of palm-kernel fat.

Messrs. S. H. Blichfeldt and T. Thornley described a method and apparatus for routine determinations of melting-points of fat and fatty acids, in which a column of melted fat 1 cm. long in a tube of 1 mm. bore, 3 mm. diameter, and 60 mm. length, is rapidly solidified on ice and kept there for two hours; the tube is then placed in a water-bath with the upper level of the column 1 cm. below the surface, and heated at the rate of 1° C. per minute. The temperature at which the column rises is taken as the melting-point. The apparatus consists of a rectangular glass water-bath holding twenty tubes, which is heated, stirred, and illuminated electrically.

THE CHEMICAL SOCIETY.

At the meeting held on March 3, Sir James Dobbie presiding, the following papers were read in abstract:—(1) "The Chemistry of the Glutaconic Acids. Pt. XII. The simultaneous occurrence of 1:2- and of 1:3-addition to glutaconic ester. A study in mobile equilibrium involving the utilisation of the labile ester in the 'nascent' condition": C. K. Ingold and J. F. Thorpe. (2) "A Second Form of 6:6′-Dinitrodiphenic Acid and its Conversion into New Cyclic Systems": J. Kenner and W. V. Stubbings. (3) "The Structural Isomerism of Oximes. Pt. III. A fourth benzildioxime": F. W. Atack and L. Whinyates.

The president announced that the guests of honour who will be entertained at the Anniversary Dinner to be held on March 17 are: Sir James Dewar, Sir Edward Thorpe, and Sir William Tilden, all past-presidents who have attained their jubilee as Fellows of the Society.

CORRESPONDENCE.

ORIGIN OF THE SOCIETY OF CHEMICAL INDUSTRY.

Sir,—It is difficult to understand the misleading statements made by Mr. Douglas Hermann in his letter relating to the inception of the Society of Chemical Industry which appeared in the *Journal* of January 31; and, as one concerned in the formation of this Society, I feel constrained to place before your readers the following facts relating thereto:—

On the occasion of a visit to Newcastle, Mr. T. W. Stuart (then manager of Messrs. Tennant's works, and now the United Alkali Co.'s general manager) invited me to attend a meeting of what was then known as The Tyne Chemical Society. Realising the great advantages accruing from the intimate association and frequent conferences of those engaged in chemical manufacture, on my return to Widnes I convened a meeting of chemists and managers of this district, which was held in the Y.M.C.A. rooms of this town, on November 21, 1879, to consider the advisability of forming a local chemical society similar to the one referred to. The following gentlemen attended that meeting: Messrs. MacIllwain, Northing, Tallon, Williamson, Taylor, Marsh, Lord, Campbell, Bottomley, Coxon, and Hargreaves. Messrs. MacIllwain, Tallon, Coxon, Campbell, with myself as hon. sec., were appointed an executive committee and held a meeting on December 1, 1879, when it was resolved that a general meeting be held on December 5, at which the following recommendation, among others, should be presented for consideration: "That the name of the society be the South Lancashire Chemical Society."

When sending out the usual notices for this general meeting, I wrote Mr. James Muspratt, inviting him to be present. The meeting was held in due course and was presided over by Mr. James Muspratt (who had not hitherto attended the preliminary meetings). It was resolved that a special committee be formed to draft rules to be placed before the next general meeting, and also to arrange time and place for such meeting. This was held on January 29, 1880, at the Royal Institution, Liverpool, Dr. Mond presiding. The following letter was received from Prof. Roscoe in reply to the secretary's invitation asking him to attend that meeting:—

"The Owens College, Manchester,
Jan. 24, 1880.

"Dear Sir,—In reply to your circular of yesterday's date, I beg to say that I consider your proposal to found a Chemical Society for Lancashire on the basis of the Newcastle Society a very useful one, and it will give me much pleasure to assist those interested in its formation in every way in my power. I regret, however, that my engagements next week prevent me from attending the meeting in Liverpool on Thursday.—Yours truly,

"H. E. Roscoe.

"John Hargreaves, Esq."

At a further meeting, held at Owens College, on April 19, 1880, the late Mr. G. E. Davis (whom I had approached privately), was appointed hon. secretary. During that meeting a few gentlemen, at Mr. Davis's suggestion, withdrew to an adjoining room, where our first subscriptions to the Society were paid. Up to that time all the expenses had been borne by me personally, and Mr. Davis insisted that I be reimbursed from the monies he then held as subscriptions. Concerning the Faraday Club and the alleged jealousy of the Widnes chemists, referred to by Mr. Hermann, I may say that the existence of this club only became known to me at that time through a local chemist when he was invited to join the projected Society.

Asked by Mr. Davis some years after the formation of the Society whether I knew the reason he attended the meeting held in the Drill Hall on December 5, 1879, over which Mr. James Muspratt presided, he declared, "I came to smash it up." Fortunately for the Society, "coming to scoff, he remained to pray." I know of no man who, collaborating with the late Mr. Tyrer, would or could have so efficiently devoted the very large amount of time and energy required in mothering the infant Society and establishing it on its present firm foundation, and without whom the Society could never have become such an influential organisation.

I give the above details—which are only a few of the facts I have available—as there seems to be so much misconception still prevalent concerning the origin of the Society of Chemical Industry.—I am, Sir, etc., JOHN HARGREAVES.

Widnes, March 1, 1921.

PERSONALIA.

The President of the Society, Sir William J. Pope, has been elected "Membre d'Honneur" of the Société de Chimie Française.

Mr. A. Chaston Chapman has been elected president of the Institute of Chemistry, in succession to Sir Herbert Jackson.

The Perkin Medal of the Society of Dyers and Colourists has been awarded to Mr. H. A. Lowe for his invention of the process for mercerising cotton under tension.

Mr. A. J. Greenaway has been appointed editor of the Journal of the Chemical Society, in succession to Dr. J. C. Cain, and Dr. Clarence Smith becomes assistant editor.

The fifteen candidates who have been selected by the Council of the Royal Society to be recommended for the Fellowship include Dr. F. W. Aston, Prof. W. L. Bragg, Prof. K. J. P. Orton, and Prof. J. C. Philip.

Dr. M. O. Forster will preside over Section B (Chemistry) of the British Association for the Advancement of Science at the meeting to be held from September 7 to 14, in Edinburgh. Sir Edward Thorpe is president-elect of the Association.

Prof. J. v. Braun, of the Berlin Agricultural "Hochschule," has accepted the chair of chemistry at the University of Frankfurt as successor to Prof. Freund, and Prof. H. Fühner, of Königsberg, has been called to the chair of pharmacology in the University of Leipzig, in succession to Prof. R. Boehm, retired.

The testing station for new medicinal preparations recently established at Berlin has been placed under the direction of Geheimrat Heffter, of the Pharmacological Institute, Berlin University, and Prof. Holste, in Jena, has been given charge of the headquarters of the Medicinal Preparations Commission of the Society for Internal Medicine.

With deep regret we record the death of the Rt. Hon. Lord Moulton, on March 9 at the age of 75.

Sir Charles A. Cameron, superintendent medical officer of public health and city analyst to the Dublin Corporation, died on February 27, at the age of 90.

The death is announced of Dr. R. Suchsland, who for over fifty years was chief chemist to Messrs. Vivian and Sons, of Swansea. The deceased was born in Frankfurt in 1839, was engaged by the late Lord Swansea in 1861, and became naturalised in the early seventies.

The death of Dr. Ignaz Stroof, one of the pioneers of the German heavy chemical industry, took place in November last, in his eighty-third year. His most important work was the introduction of the electrolytic method of manufacturing caustic alkali by the diaphragm process.

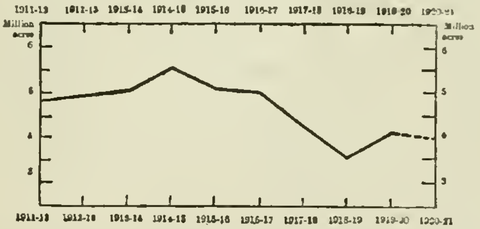
We regret to record the death in February of Mr. John R. Griffin, of Messrs. J. J. Griffin and Co., Ltd., who joined the Society in 1890, and recently took a very active part in the work of the committee appointed by the Council to investigate the standardisation of laboratory glassware (*cf.* J., Aug. 15, 1919; also the death of Mr. S. H. Blichfeldt on March 3, after a very short illness.

NEWS AND NOTES.

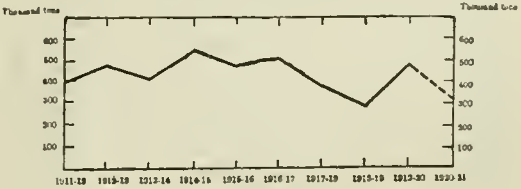
BRITISH INDIA.

The Sesamum Industry.—The *Indian Trade Journal* of January 28 contains the detailed final memorandum on the sesamum crop of 1920–21, together with charts (reproduced below) showing the present estimates of the total area and yield as compared with the final figures of the preceding nine years:—

Area under Sesamum (in million acres).



Yield of Sesamum (in thousand tons).



Exclusive of Burma, which contains nearly 25 per cent. of the area under sesamum in British India, the total area under the crop is reported to be 3,964,000 acres, or 2 per cent. below the corresponding revised estimate last year, and the total yield (Hyderabad and Burma excluded) is estimated at 323,000 tons, which is 20 per cent. below the forecast this time last year. The condition of the crop is reported to be fair on the whole.

Indigo Cultivation in Assam.—Recent experiments appear to indicate that indigo grown in Assam will prove a formidable competitor of synthetic indigo. Plants have been grown in Assam containing 0·7 per cent. of indigotin in the leaf, yielding 60—80 lb. of cake indigo per acre. A company called "Assam Indigo, Ltd.," has been formed for the purpose of producing indigo by modern methods.—(*U.S. Com. Rep., Feb.* 4, 1921.)

AUSTRALIA.

Oil Exploration.—Stimulated by the Government's offer of a prize of £50,000, the search for oil in paying quantities is being pursued vigorously. The Northern Territory, Papua, and South Australia are being explored, but so far only the Roma bore in Queensland and the bores in Papua are considered hopeful; in neither of these localities has oil yet been produced on a commercial scale.

New South Wales.

Cultivation of Groundnuts.—Many farmers are now cultivating this crop. The heavy loams of the northern coast of the State are the most suitable, but some good crops have been obtained on the Murrumbidgee irrigation areas. A firm in Sydney is erecting an oil-extraction plant which, it is hoped, will be in full working order before the next crop is harvested.

Victoria.

Chemistry at Melbourne University.—In commemoration of its late chairman, Mr. James Cumming, a leader of Victorian chemical industry, the directors of Cumming, Smith and Co., Pty., Ltd., have offered the sum of £5000 towards the erection and equipment of a research laboratory and lecture-theatre in the University of Melbourne. The offer is being considered by the council of the University.

Western Australia.

Forest Products.—The following notes have been abstracted from the recently issued Report of the Conservator of Forests for the year 1919–20. The gross value of exported timber during the year, including sandalwood, amounted to £743,373, an increase of £263,307 over the previous year.

Kiln Drying.—The future of kiln drying of jarrah being assured, both by the results obtained by the Department and by local firms in their commercial driers, the timber kiln erected at Crawley has been operated during the year with a view to overcoming some of the difficulties encountered. It is hoped that before long all the information required to enable such kilns to be operated easily and successfully will be available.

Tan Barks.—The value of mallet bark exported amounted to £22,121, or £3246 more than in 1918–19. Mangrove bark has come into prominence, analysis having shown that the black mangrove (*Bruguiera gymnorrhiza*) contains 46 per cent. and the red mangrove (*Ceriops candolleana*) 44 per cent. of tannin. Marri kino tannage continues to be used for sole and harness leather. The tanneries of Western Australia are still dependent on Natal wattle bark, and every attempt should be made to find local substitutes to reduce this importation. The trees and shrubs in the State contain sufficient tanning-bearing materials not only for local tanneries, but also for export.

Sandalwood.—This trade is a purely Chinese one, and the average quantity of sandalwood absorbed by China during the past 70 years is 4500 tons per annum. During the year under review, however, the cut amounted to 17,269 tons. This very large increase is difficult to explain, but the main cause is probably the very high rate of exchange which followed the rise in the price of silver, and consequently of the Chinese dollar. Owing to the alarming rate of cutting, an attempt was made to regulate the industry by raising the royalty on the wood from 5s. to £2 per ton. Although this gives a considerably increased revenue, it does not affect the main object of regulating the supply of wood to that quantity which China can absorb, and so assuring a continuous trade at a maximum price. During the year 5572 lb. of sandalwood oil was extracted locally, an increase of 1852 lb. over the previous year's output.

Kingia Grass Tree Fibre Industry.—This new industry is developing gradually and the excellence of the fibre for broom making and other purposes has been proved. During the year the "Dibenya" fibre works shipped 27 tons to the Eastern States, and a second factory has just started operations. So far only the fibre of this tree has been used; the outside is stripped in the bush and the inside core also goes to waste. This is a matter demanding immediate attention, for at the present time only about one-fifth of the crop is being utilised.

CANADA.

Glass Production in Vancouver.—A large plant for the manufacture of table ware is under construction at Westmoreland, near Huntingdon, in West Vancouver, for the West Virginia Glass Manufacturing Co.; it will include a glass furnace, said to be the largest in the world, employ 400—500 workpeople, and be ready for a trial run in April.—(*Oil, Paint and Drug Rep., Jan.* 31, 1921.)

FRANCE.

Industrial Notes.—*Coal.*—The French coal industry was decontrolled on March 1, and the supertax of 28 per cent. abolished; the pithead tax is retained in order to keep down prices. The supertax was intended to equalise the prices of home and foreign coal, but as the differences in price have of late been reduced by nearly 50 per cent. its continuance is unnecessary. The total output of coal in France, including Lorraine, was 25,276,304 tons in 1920, compared with 22,476,766 t. in 1919. The total production of coke made from Saar coal is about 87,000 t. monthly; the average selling price of the coal and coke is about 97 francs per ton, and the profit 13 fr. per ton, half of which has to be applied to extension work. In view of the possible eventual restoration of the Saar mines to Germany, it is proposed to exploit them to the fullest extent.

Metallurgy.—Opposition to the great metallurgical syndicates continues to grow. The Comptoir de Longwy, as already announced, has been liquidated; it is rumoured that the Comptoir des Fontes Hematites will soon share the same fate; and the Comptoir Sidérurgique, which sells and distributes semi-manufactured and manufactured products, is also becoming unpopular. The opposition emanates from the federation of producers that has been formed since the war, and which by reason of its control of blast furnaces, steel works, rolling mills and a powerful selling organisation, no longer requires intermediaries such as the syndicates mentioned above. It is, however, doubtful if these can be permanently dispensed with, as the country is already producing twice as much pig iron as it consumes, and central organisations will be required to dispose of the surplus production to foreign buyers.

Chemical Industry.—German competition in fine chemicals is steadily growing. French producers who had found a market in Brazil, Chile, and Argentina are being gradually ousted by Darmstadt and Hamburg firms which undersell them by about 10 per cent. on quoted prices. Competition is not so active in heavy chemicals on account of the long periods required for delivery and of the high transport rates. The prohibition of the export of new and scrap celluloid, oil of turpentine and fertilisers has been revoked in order to facilitate the liquidation of existing stocks.

UNITED STATES.

Treatment of Alkaline Soils with Sulphuric Acid.—Considerable interest has been aroused by favourable results obtained in the south-west by the direct application of sulphuric acid to adobe soils. Plots upon which nothing had been raised hitherto proved to be fertile after this treatment. This is said to be due both to the correction of super-alkalinity and to improvement in the physical character of soils treated.

Extraction of Potassium Chloride and Borax from Natural Brines.—At Keeler, California, a new process is being worked for recovering potassium chloride and borax in marketable form from natural brines. After securing the greatest possible concentration by solar evaporation the liquor is treated with carbon dioxide to free it from the carbonates of soda. It is then concentrated further in double-effect evaporators and submitted to fractional crystallisation.

Propyl Alcohol from Wood Waste.—A process for making propyl alcohol from the waste gases of the Burton petroleum-cracking still is being worked commercially. These gases contain large quantities of propylene, and after hydrogen sulphide has been removed they are passed through sulphuric acid, which combines with the propylene, and propyl alcohol is then obtained by distillation. Isopropyl alcohol can be oxidised directly to acetone, or a series of esters of commercial importance can be made from it. The new alcohol will be called "petrohol," and the present capacity of the plant is 250 galls. per day. It is anticipated that this alcohol will be produced in competition with methanol, the new commercial term for wood alcohol, as a solvent for gums and resins.

The Chemical Warfare Service.—The American Chemical Society, through its Committee on National Policies, has communicated the following resolution to members of the Senate and the House of Representatives:—

"While in complete accord with the spirit prompting the restrictions of appropriations by the present Congress, nevertheless the American Chemical Society's Committee on National Policies would urge upon the Congress more favourable provision for the Chemical Warfare Service than is contemplated by the amount set by the House of Representatives—$1,500,000. The carefully prepared estimates of the officers of that Service, slightly less than $4,500,000, represent less than 1½ per cent. of the total appropriation for the army carried in the House bill. This amount is to care for the valuable property of the Government at Edgewood Arsenal, to enable the continuation of research on new lines of defence and offence, and to provide for the training of special troops and for the instruction of the entire army in all features of gas warfare. In view of the tremendous increase in the use of gases during the last year of the war, and of the fact that approximately 30 per cent. of the casualties of our army in the war was due to gas wounds, we feel that the proposed reduction to one-third of the appropriation asked would so seriously cripple the development of the Chemical Warfare Service as to constitute a matter of grave national concern. We therefore urge that the Congress appropriate the original amount asked for the Service in the estimates submitted."

Mica in 1918.—A report of the United States Geological Survey issued in 1920 gives the production of mica in that country in 1918 as 3114 short tons, which comprised 822 t. of sheet and 2292 t. of scrap mica. As in previous years (*cf.* J., 1918, 437 R), the greatest production was in North Carolina, but increasing quantities of excellent mineral are now being obtained from the Thomaston field in Georgia. Production is apparently at its maximum, the stimulus of high prices and a ready market having had little effect. Of the mica imported in 1918, 54 per cent. came from India, 26 per cent. from Canada, and 15 per cent. from Brazil. The value of the imports, $1,541,129, was approximately double that of the exports.

No figures are available for the world's production in 1918, but India and Canada produced 3062 and 374 t. respectively. To-day the largest consumers are the United States and Great Britain, followed by France and Italy, Germany having lost her leading position in the European electrical industry to England. The future development of mica deposits depends to some extent on the success of various substitutes, *e.g.*, compressed-paper products, bakelite, etc. So far there appears to be no satisfactory substitute for sheet mica used in electrical insulation, for which purpose no less than 86 per cent. of the sheet mica and splittings produced is utilised. About 98 per cent. of the world's output of sheet mica is supplied by India and the United States (muscovite) and Canada (phlogopite). The demand keeps pace with increasing production, and important developments may be expected in British East Africa, Nyassaland, and Rhodesia.

Nitrobenzene-Poisoning.—A peculiar case of poisoning due to nitrobenzene has been reported. A workman who treated his shoes with a preparation containing this substance and wore them immediately was taken ill within three hours. The desirability of not wearing shoes so treated within three or four days of treatment and applying the substance in a well-ventilated place are emphasised.

SOUTH AFRICA.

Industrial Progress.—The report of the General Manager of Railways and Harbours for the year 1919–20 records considerable industrial expansion. Although attention has been devoted mainly to expanding and modernising existing industries, new industries are still springing up, and they have been to a great extent shielded from foreign competition by the continuance of war-prices in exporting countries. Compared with the year 1915–16, there are 2044 additional factories, 41,910 more employees, and the value of the production has increased by £30,000,000.

The iron and steel industry should in time become one of the most important in the Union. Although small it is making satisfactory progress. In 1919 the production of iron and steel goods from local furnaces was valued at £406,000, and 1967 tons of pig iron, valued at £12,500, was produced from local ore. The trade in wattle bark and wattle-bark extract continues to grow; 96,124 tons of bark was shipped from Durban during the year ended March, 1920, and eleven mills for making extract have been established or are in course of erection. The value of the exports in this industry has increased from £195,000 in 1909 to £603,000 in 1919. The tanning and leather goods industry has been active throughout the Union, notably at Durban, Port Elizabeth, King William's Town, Wellington, Pretoria, and Middleburg There is a ready market for local products, and the factories are unable to keep pace with the demand. Leather and leather goods to the value of £62,000 were exported in 1919, or £56,000 more than in 1909.

JAPAN.

The Cement Industry.—The Nagoya Cement Co. has recently completed its plant at Tokyo, and the output, which it is anticipated will reach 200,000 barrels per annum, will be taken largely by hydro-electric companies. The company owns mining rights for limestone in the Shiga and Miye Prefectures.—(*U.S. Com. Rep., Jan.* 4, 1920.)

GENERAL.

Mercerised Cotton.—As announced on page 87 R, the Perkin Medal of the Society of Dyers and Colourists has been awarded to H. A. Lowe for his invention of mercerised cotton under tension.

The process of treating cotton with a strong solution of caustic soda produces a change in the fibre known as "mercerisation," a word derived from the name of John Mercer, who first drew attention to the phenomenon in 1844, but today it is more particularly associated with cotton upon which a lustre has been produced by treatment with caustic soda while under tension. The production of a permanent lustre was the discovery of Horace A. Lowe, whose patents were taken out in 1889 and 1890. Lowe, then a young chemist in a Lancashire bleach-works, experienced so much difficulty in getting the process taken up that he allowed his patents to lapse. The process was first carried out on a commercial scale in 1895 by Thomas and Prevost of Crefeld, who took out a patent, apparently in ignorance of Lowe's previous discovery. The mercerised yarns produced by this firm met with such success that the process was widely taken up. In the litigation which naturally followed, the priority of Lowe's invention was clearly established, and Thomas and Prevost's patent was annulled. Lowe subsequently carried out his process at a works opened for the purpose near Manchester, and after a short time this was taken over by the Fine Cotton Spinners' Association, who began the production of mercerised yarns on a very large scale. Today mercerisation is one of the most important processes in use in the cotton dyeing and finishing trade.

Former recipients of the Perkin Medal have been von Baeyer for the synthesis of Indigo, Graebe and Liebermann for the synthesis of Alizarin, de Chardonnet for the invention of the first artificial silk, and Prof. Arthur Green for the discovery of Primuline.

"Bismuth (1913—1919)" (pp. 14, price 6d.) has been recently published by the Imperial Mineral Resources Bureau as an advance "part" of its annual volume on the Mineral Resources of the British Empire and Foreign Countries. The Bureau does not appear to be able to add appreciably to our knowledge concerning the production and marketing of bismuth ores, metal, or compounds. The table headed "World's Production of Bismuth" shows figures which are of little value, as it only gives the production of ore, concentrates, residues, etc., without stating the bismuth content and without giving the values. The largest producing country is Bolivia, which in 1918 was stated to have produced 245 tons of bismuth ingots, presumably sent to England to be refined. As a rule, the Bolivian native bismuth and high-grade concentrates are shipped to Europe and the United States for treatment, only the low-grade concentrates carrying less than 10 per cent. bismuth being smelted locally. Australia is a producer on a considerable scale and, although no figures are given for the production in the United States, the supply obtained during the process of smelting and refining lead and copper ores in that country must be an important source of the metal. Smaller quantities of bismuth ore have been produced in Rhodesia, India, Burma, China, and Norway. Figures for Germany are not available, but this country is normally an important producer.

During the war there was an increased demand for bismuth both for the manufacture of certain low-temperature fuses and for medicinal purposes. Both the production of bismuth and the market price of the metal have been strictly controlled for many years. Messrs. Johnson, Matthey and Co., Ltd., are the chief buyers, and they report official prices per lb. of the metal as follows:—January, 1912, to August, 1914, 7s. 6d.; August, 1914, to March, 1916, 10s.; March, 1916, to January, 1918, 11s.; January, 1918, to January, 1920, 12s. 6d. It is stated that bismuth ore to be marketable should contain at least 10 per cent. metallic bismuth, but it is well known that tinny and other residues containing 5 per cent. have been readily saleable during the last few years.

Palm Oil as Fuel for Internal Combustion Engines.—Major Trentels, of the Belgian colonial army, has recently described some interesting trials of palm oil in a two-cycle semi-Diesel engine of 8—10 h.p. at 500 rev. per min. The only special feature related to the means for keeping the fuel liquid, and this was accomplished by using the cylinder cooling-water in conjunction with the hot exhaust-gases. The engine was started on petrol, and arrangements were made for the termination of the run to be carried out on the same fuel so as to remove palm oil from the feed pipes. The palm-oil consumption was 0·68 to 1·21 lb. per h.p.-hr. for powers between 3·5 to 120 h.p. The calorific value of the fuel was 16,610 B.T.U., and its price was 250 fr. per metric ton (crude petroleum being about 2000 fr. per metric ton). Other vegetable oils have been suggested at various times for use as motor fuel, such as castor oil and groundnut oil, but the advisability of using for fuel any oil which can be utilised for edible purposes is very doubtful.—(*Times Eng. Suppl., Feb.*, 1921.)

The Chemical Treatment of Seeds.—Various methods of treating seeds have recently been brought forward in France to improve vegetative growth and to obtain increased yields by steeping them in a solution containing a fertiliser, *e.g.*, potassium nitrate, ammonium sulphate, ammonium phosphate, etc., either singly or in admixture. Investigations by Dr. Worley, of Munich, in 1886 led him to conclude that the steeping of seeds in such a solution has no more effect than immersion in pure water; that germination in such cases is stimulated solely by imbibition; and that solutions of many fertilisers are harmful unless used in very low concentration. Later, M. André, of the Institut National Agronomique, found that most seeds are killed even by a very weak acid solution, and that although many saline solutions facilitate germination when used in concentrations not exceeding 0·2—0·4 per cent., they might be harmful in higher concentrations. Further trials were carried out in France by M. Bachelier, using barley seeds and potassium nitrate, but the results, like those obtained by various Agricultural Services, were inconclusive. The excellent results said to have been obtained by M. Pion-Gaud, who used a 2 per cent. solution of ammonium nitrate, were due less to steeping than to special methods of cultivation. Certain liquids of secret composition, reported to have given favourable results, are now being officially investigated. The general conclusion seems to be that, although germination can be stimulated by steeping the seed in a nutrient liquid, pure water is sufficient and preferable.—(*Official.*)

Guano Deposits on Latham Island, near Zanzibar.—The central plateau of Latham Island, a small island situated to the south-east of Zanzibar, is covered with a deposit of guano one foot deep, a sample of which was analysed at the Imperial Institute and found to contain: Citric-soluble P_2O_5, 19·1% (total P_2O_5, 29·52%); K_2O, 0·33%; and CaO, 35·36%. It resembles the guano obtained from Saldanha Bay, South Africa, and contains more phosphate and less nitrogen than typical Peruvian guano. Freight rates are at present too high to permit of exporting the guano to the United Kingdom, but a market might possibly be found for it in East Africa or Zanzibar.—(*Bull. Imp. Inst.*, 18, 2, 1920.)

The Effect of the Inhalation of Gases.—Under this title, Dr. G. A. Welsh summarises his experiences at H.M. Factory, Gretna, in the January issue of the *Journal of Industrial Hygiene.* Volume for volume, says Dr. Welsh, the compounds of sulphur and oxygen are less dangerous than nitrogen oxides or nitrosyl chloride, and sulphuric acid fumes are less harmful than those of nitric acid. From the nature of the substance causing gassing and from observation of the symptoms, it is possible to give a fairly accurate prognosis in all cases except those of gassing by nitrogen peroxide and nitric acid mist. In the majority of severe cases the urgent symptoms subside in 24 hours, although a few last for 48 hours; and it is then a question of dealing with pharyngitis, laryngitis, bronchial irritation or bronchitis. With pharyngitis and bronchitis it is advisable to give the patients a change of air and surroundings for a week before certifying them as fit to return to work.

The wearing of respirators by operatives was discontinued at Gretna after many trials; the operatives dislike them, and as gassing is usually the result of an accident, it is impossible to be sure that the operative will be wearing a respirator at the time of the accident. The only exception is the wearing of moist cotton-wool well over the mouth and nose by nitrocotton dippers; this cannot be called efficient, and only a self-contained apparatus, such as the "Mecco" has been found to trap nitrogen peroxide fumes effectively. The Mecco provides an atmosphere of oxygen from a cylinder and removes carbon dioxide with caustic soda. Of the 361 cases of gassing which occurred at Gretna, only one—a man who inhaled vapours of fuming nitric acid while working in a closed space—ended fatally.

Systemic poisoning, due to inhaling small quantities of toxic fumes from time to time, can only be cured by removal from work and change of air, when a very simple treatment—light fluid diet and alkaline saline mixture—restores to health. There is no evidence that sound teeth are affected by inhaling harmful gases, but if a tooth is already diseased decay is accelerated. Operatives are warned in every case to pay especial attention to the cleansing of the teeth. The article also describes symptoms and first-aid treatment.

Chromium Deposits in Serbia and Bosnia.—The chromium deposit at Raotina, near Skoplje, along the Vardar river, has been worked sporadically in the past. During the war it was exploited by the Germans, who obtained a daily output of about 150 tons. They also worked a second deposit, about 2 kilom. distant from Raotina. Chrome ore was first worked at Dubostica, in Bosnia, in 1884, and during the war the output was about 2000 tons a month. The deposit, which is of considerable extent and width, is owned by the Jugo-Slav Government. Operations are at present suspended, but will be resumed. About 520 t. of high-grade ore was awaiting transportation in June last.—(*U.S. Com. Rep., Dec.* 20, 29, 1920.)

Bauxite Deposits in Istria and Dalmatia.—Little attention was paid to these deposits until during the war, when Germany was obliged to replace supplies formerly derived from France. Exploitation began in 1916, and by the end of 1918, 95,000 metric tons had been exported from Dalmatia and 70,000 t. from Istria. The deposits occur in two zones parallel to the Dinaric Alps, one zone—the most important—being on the mainland and the other on the islands. The ore contains 50—52 per cent. Al_2O_3, 20—24 per cent. Fe_2O_3, and small amounts of silica. Large reserves of ore are said to exist, and as ample water power could be obtained from the river Cherca, the district is suitable for the establishment of an aluminium factory.—(*G. Chim. Ind. ed App., Nov.*, 1920.)

Iron Ore in Switzerland.—The iron mines in the vicinity of Gonzen (Toggenburg) produce 80—100 tons of ore daily, which is transported by telpher. As Switzerland has no blast furnaces, the ore is sent to Germany to be smelted. At the present time production has been greatly reduced on account of the crisis in the iron industry.

The Lignite Mines of Semsales (Switzerland).—In 1920 these mines, which are situate near Fribourg, produced 8000 tons of lignite, of calorific power 5500, which were sold at an average price of 22 francs per car-load. Owing to the reduced price of coal, half of the labour employed has been dismissed, and the other half was offered a reduction in wages of 33 per cent., *i.e.*, from 1·20 fr. to 0·80 fr. per hour. The offer was accepted, as the workers knew that if they refused the whole undertaking would be closed down. The men working above ground now work for 10 hours daily.

Chemical Industry in Czecho-Slovakia.—Since the foundation of the Czecho-Slovak Republic its chemical industries have appreciably recovered from the depression which prevailed during the war; they are well organised individually and also form part of a larger association, the Federation of Czecho-Slovak Industries at Prague. The chemical factories were mainly erected in Bohemia and Moravia, doubtless owing to the excellent transport facilities afforded by the Elbe and the Moldau. Important fertiliser plants are located at Kolin, Slany, Prerau, and Brünn, and those at Slany and Prerau also manufacture glue. Pharmaceutical products are made at Chrast, near Chrudim, and in Prague acids and explosives by the Nobel Dynamite Co. at Bratislava, and paints, varnishes, and shellac at Usti (Aussig). Mineral colours, especially ultramarine and Paris blue, chrome, and zinc colours, are made in many Bohemian towns, and coal-tar dyes are produced by the Aussig Chemical Co. at Usti, and by Kinziberger and Co. at Prague. The dye industry is not firmly established, German competition having proved too formidable in spite of a special high tariff. Ink is made by many firms, and at Ceske Budejovice (Budweis) is the famous plant of L. C. Hardtmuth, making pencils and colours. The manufacture of shoe-blacking is rapidly developing chiefly in North Bohemia. Factories producing greases, oils, essential oils, etc., are found chiefly near the large towns; before the war the production of vegetable oils, *e.g.*, linseed oil, was an important industry in Bohemia, but recently it has had to face competition from the cheaper fish and mineral oils. The soap industry has also suffered from foreign competition, and, since the war, from the liquidation of Government supplies of fats and oils; the largest factory is that of G. Schicht, near Usti, which employs more than 4000 workers. Starch and starch-products are made almost entirely in Moravia and the adjoining parts of Bohemia (*cf.* J., 1920, 17, 275, 306, 400, 438 R).—(*U.S. Com. Rep., Jan.* 21, 1921.)

Discovery of Lead-Silver Ore in Italy.—A rich lode of argentiferous galena has been found in the Alpine part of Valtellina (the upper Adda valley, N. Italy); it is extensive and runs vertically for about 50 ft. into the mountain. About 15 square metres have been opened up, and the ore assays over 65 per cent. of lead, 8 per cent. of silver, with traces of gold and copper.

The Sugar Situation in Italy.—The Italian production of beet sugar in 1920 is estimated at 120,000 metric tons, compared with 192,000 t. in the previous year, the reduction being due, it is believed, to the fixing of the price of beets, which made it more profitable to grow other crops. Sugar is rationed at the rate of 1·1 lb. per head per month, but the home production is insufficient, and importation is necessary. During 1919, 73,000 t. was imported, of which the United States supplied 60,000 t., but during the first eight months of 1920 the total importation was reduced to 6500 t.—(*U.S. Com. Rep., Feb.* 5, 1921.)

Italian Chemical Periodical Literature.—With reference to the statement which appeared on p. 2 R (1921) of this Journal, we are asked to state that the *Giornale di Chimica Industriale ed Applicata* is published jointly by the Associazione Italiana di Chimica Generale ed Applicata of Rome and the Società di Chimica Industriale of Milan.

LEGAL INTELLIGENCE.

Sale of Chemicals in a "Job Lot." *W. Barnes and Co. v. C. Wallington and Co.*

In the King's Bench Division on February 17, Messrs. W. Barnes and Co., London, sued Messrs. C. Wallington and Co., of London, to recover damages for alleged breach of contract.

On behalf of plaintiffs it was stated that, after inspection, they had purchased from the defendants some sulphate of soda and soda ash lying in a warehouse. According to the contract notes there were approximately 4½ tons of soda ash at £4 per ton and about 40 tons of sulphate of soda in bags at 30s. per ton, but the defendants only delivered 3 tons 12 cwt. of soda ash and 15 tons 3 cwt. of sulphate of soda. Damages were also claimed because some of the material had to be re-bagged. Without hearing evidence for the defence, Mr. Justice Rowlatt gave judgment for the defendants, with costs. It was abundantly clear that the goods sold and bought "as inspected by purchasers" were a heap—a job lot at a low price, and, in the position they occupied, uncountable; the words "about" and "approximately" meant that the amount was only estimated for the purpose of fixing the price. The plaintiffs' claim in respect of re-bagging also failed.

Validity of Pre-War Contracts. *E. W. J. Coppee and Others v. Blagden, Waugh and Co.*

This action was heard before Mr. Justice Rowlatt in the King's Bench Division on February 17. On behalf of plaintiffs it was stated that they carried on business in Belgium, and that early in 1912 they made nine contracts with the defendants for the sale to them of very large quantities of benzol and naphtha, deliveries to last from the beginning of 1914 to the end of 1918. Plaintiffs now asked for a declaration that the contracts were void on the grounds that (1) under the Proclamation of September, 1915, trading with the plaintiffs was forbidden as they were in territory occupied by the enemy; (2) long delay had occurred; and (3) under the Courts Emergency Powers Act, the Court could annul contracts if it was of opinion that the contracts could not be carried out without serious hardship to the contracting parties. Counsel for the defendant company agreed that the contracts still subsisted by virtue of the clause providing that contracts should be suspended in case of war. He also said that the Act referred to did not apply to Belgians, but only to British subjects.

His Lordship held that there had been complete frustration of the contracts owing to the German occupation of Belgium. The suspensory clause did not provide for such a casualty as that which had overwhelmed the plaintiffs and entirely changed the conditions of the contract. Judgment was given for the plaintiffs for the declaration claimed, with costs.

PARLIAMENTARY NEWS.

HOUSE OF COMMONS.

Imports from Germany.

In a written answer to Capt. Terrell, Sir P. Lloyd Greame gave the values of the imports from Germany during the third and fourth quarters of 1920 as £8,743,000 and £10,494,000, respectively. The more important increases were as follows:—

	Third Quarter. Tons.	1920.	Fourth Quarter Tons.
Earthenware	420·6		668·4
Glassware, illuminating	773·4		532·5
Glass bottles	4380·8		5665·4
Lead, pig	1762		3884
Zinc, crude	1644		7671
Potassium nitrate	12		806·4
Silver nitrate	6·2		13·2
Coal-tar dyes	1186·6		2968·4

The values of the coal-tar dyes imported during the two quarters were £1,010,546 and £3,041,798, respectively.—(Feb. 21.)

British America Nickel Corporation.

Sir P. Lloyd Greame, in an answer to Mr. Armitage referring to the statements made in the Seventh Report from the Select Committee on National Expenditure, said that the British America Nickel Corporation, in which the Government had invested $3,000,000 (*cf.* J., 1918, 14 R), had put forward a scheme to raise further working capital and to modify the rights attaching to the various capital issues of the Corporation. No further liability was imposed on the Government by the scheme, which offered the best prospects of a satisfactory realisation of the investment.—(Feb. 21.)

The Dyestuffs (Import Regulation) Act.

In reply to Major Barnes and Mr. Waterson, Sir P. Lloyd Greame said that no decision had been made to restrict the importation of goods under the Dyestuffs Act to those for which the applicant had a definite order, but it would facilitate the granting of licences if it were clear that the dyestuffs were ordered for persons who required them. A complete list of commodities covered by the Act would be available shortly, and information as to the quantities of dyestuffs and other products licensed under the Act would be published periodically; no useful purpose would be served by publishing a list of the firms that had received licences. The refusal to grant an import licence for 2 cwt. of salicylic acid (B.P.) for pharmaceutical purposes would be reconsidered if the applicants could satisfy the Dyestuffs Advisory Licensing Committee that the consignment was of B.P. quality, and intended solely for medicinal use, and if they would undertake to prove later that it had been so used.—(Feb. 21.)

Food Values.

Dr. Addison informed Capt. Elliott that the publication of a pamphlet giving information on the dietetic values of foods was being considered, and certain researches relating thereto were being conducted in collaboration with the Medical Research Council.—(Feb. 25.)

Imports of Gas Mantles.

In a written reply to Sir J. Norton-Griffiths, Sir R. Horne stated that 46,938 gross (value £101,973) of incandescent gas mantles was imported during the six months ended January 31, 1921, and that this quantity was small compared with that in pre-war years. He was aware of the difficulties experienced by the British industry through lack of orders.—(Feb. 28.)

Foreign Competition in the Coal Trade.

Answering Lieut.-Col. Sir F. Hall, Mr. Bridgeman said that the United States exported 476,000 tons of coal to Europe in the year ended June, 1913, and 13,383,000 t. in the calendar year 1920; the coal exported from Australia to Europe was 100 t. in 1913 and 113,000 t. in 1920. The British output of coal during the last six weeks of 1920 seemed to show that a further 13 million tons might have been produced during the year without employing additional labour.—(Feb. 28.)

Sugar Industry (Foreign Competition.)

Mr. Chamberlain, in a written reply to Capt. Bowyer, said that all restrictions on the import of sugar were removed on Febuary 26, after full discussion with the refiners. Apprehensions regarding the effect on the sugar industry of competition from countries enjoying cheaper labour and a favourable exchange were premature, but no statement as to future legislation could be made.—(March 1.)

The Key Industries Bill.

Sir P. Lloyd Greame, replying for the Prime Minister to Mr. Terrell, announced that the above Bill would be introduced and proceeded with immediately after Easter.—(March 9.)

REPORTS.

General Report on the Industrial and Economic Situation of Norway in December, 1920. *By* C. L. Paus, *Commercial Secretary to H.M. Legation, Christiania. Department of Overseas Trade. Pp. 75. London: H.M. Stationery Office.* 1921. [*Cmd.* 1145. 9*d.*]

The previous report on Norway (*cf.* J., 1920, 364 R), which covered the war-period down to the end of 1919, has now been supplemented by a general report for the year 1920.

Norway, like other nations which knew prosperity during the war, has now become engulfed in the world-wide depression. The brighter prospects which were apparent in the early months of 1920 disappeared quickly, and the slump which followed has gradually extended to nearly every branch of industry and commerce; labour problems, social unrest, financial stringency, and an abnormal exchange, all contribute to the general depression. The balance of trade is very adverse, and much capital is locked up in stocks. German exporters, favoured by the conditions of exchange, can now undersell all competitors, and are in fact offering their goods, including drugs and chemicals, at very low prices for prompt delivery. Several large German firms have opened offices in Christiania.

The market for heavy chemicals was (in December) very uncertain, and owing to the curtailment of production by the pulp and paper mills, demand was practically non-existent. America sent considerable supplies during the year, and at the close Germany was offering cheap goods to an already glutted market. Many of the factories erected at great expense during the war cannot pay dividends on the invested capital, and with few exceptions production has been greatly curtailed. The carbide industry has suffered from the shortage and high price of imported anthracite; two factories have closed down and the rest are working at 30—40 per cent. of their capacity. The ferro-silicon works are in a still worse position, and the demand for aluminium and refined zinc, which was good in the early part of the year, has diminished. Mining has been hampered by dear labour and fuel, high freights, and difficulty in obtaining payment from Germany. Production of iron ore has ceased, and pyrites mining is very restricted; it does not pay now to extract the copper from cupreous pyrites owing to the low price of the metal. Nickel, chromium, and molybdenite mines remained closed throughout the year. In the paper-making industry, Finnish and German competition is being felt; the boom which prevailed at the beginning of the year has passed, demand is negligible, and the mills have cut down their production to one-third or less. Exceptionally, the margarine industry has escaped the prevailing depression; demand is described as normal, but profits, owing to competition, will be small. Soap-makers, too, have been busy, and as they are independent of imported oils, they can undersell foreign manufacturers. The nitrate factories controlled by the Norwegian Hydro-electric Nitrogen Co. and the Cellulose and Mechanical Pulp Mills are reported to have been fully occupied throughout the year and to have sold their output some months ahead; it is, however, anticipated that prices will fall.

Report of the Departmental Committee on Control of Certain Therapeutic Substances. *Ministry of Health. Pp.* 13. *H.M. Stationery Office.* 1920. [*Cmd.* 1156. 2*d.*]

This Committee was appointed by the Minister of Health in April, 1920, "to consider and advise upon the legislative and administrative measures to be taken for the effective control of the quality and authenticity of such therapeutic substances offered for sale to the public as cannot be tested adequately by direct chemical means." The substances referred to are classified as follows:—A. Such products as vaccines, sera, toxins and antitoxins; B. Synthetic chemicals, such as salvarsan and its analogues; and C. Galenical and other preparations administered through the mouth, such as digitalis, strophanthus, squill, ergot, etc. Substances in A and B are not included in the British Pharmacopœia; the standardisation of those in A is left at present entirely to the manufacturer, but those in B are subject to a measure of Government control, *e.g.*, the Board of Trade issues licences for the manufacture of salvarsan, attached to which are conditions relating to maximum prices and testing by the Medical Research Council. Most of the substances in C are included in the B.P., but it is held by many that the standards therein prescribed are inadequate.

The recommendations of the Committee include the following:—Therapeutic substances which cannot be tested adequately by chemical means should be subject to supervision and control; the controlling authority to be the Committee of the Privy Council appointed under the Ministry of Health Act, 1919, assisted by an advisory committee. A central laboratory should be established under the Medical Research Council for preparing standards, conducting research, and testing samples taken from manufacturers' stocks or bought in the open market. Manufacturers should be licensed, and their plant, premises and processes inspected, but in the case of substances in B and C, inspection should be confined to the records and methods of biological testing, and, when necessary, to the filling and sealing of the containers. Similar restrictions should apply to products made abroad. Imported goods must fulfil the same conditions as to purity, etc., as home-manufactured goods; they should bear an approved form of label, and come under Section 42 of the Customs Consolidated Act of 1876. Fresh legislation would be necessary to give effect to these recommendations.

OFFICIAL TRADE INTELLIGENCE.

(*From the Board of Trade Journal for February* 24 *and March* 3.)

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W. 1, from firms, agents, or individuals who desire to represent U.K. manufacturers or exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department and quoting the specific reference number:—

Locality of Firm or Agent.	Materials.	Reference number
South Africa	Glassware, paper	273
„	Druggists' sundries, disinfectants, fertilisers	274
„	Paint, varnish, crockery	250
Denmark	Non-ferrous metals, iron tubes	277
France	Industrial chemicals, drugs	279
„	Drugs	280
Italy	Heavy chemicals, copper sulphate, caustic soda, soda crystals, fertilisers, oils, fats	281
„	Chemicals, non-ferrous metals	282
Rumania	Sugar, olive oil, soap	283
Spain	Non-ferrous meta	284
Sweden	Paint	286
United States	Raw materials for paint manufacture, dyes for textiles	289
Mexico	Black and galvanised pipes, corrugated roofing, wall and floor tiles, sanitary ware	266
Argentina	Lubricating oils and greases	292
„	Earthenware	293

TARIFF, CUSTOMS, EXCISE.

Belgium.—Beet syrup may now be exported within limits to be fixed by the Ministry of Industry, Labour and Supplies.

British Guiana.—A copy of the new Preferential Customs Tariff may be seen at the Department. Among the articles that are admitted at half rates under the British Preferential Tariff are certain kinds of iron and steel, common soap, fertilisers, vermin killers, insecticides, and patent medicines containing not more than 50% of proof spirit.

British Honduras.—It is proposed to reduce the export duty on all alcoholic beverages to 5 per cent. *ad valorem.*

British India.—The tariff valuations of exported raw hides and skins have been revised with effect from February 5.

Chile.—It is proposed to exempt from increased customs duties condensed and dried milk, cocoa, sugar, petrol, and oils.

Denmark.—Import prohibitions have been removed from nitric, oxalic, and sulphuric acids, nitrates, chlorates, oxalates, perchlorates, glycerin, carbolic acid, aniline benzene, toluene, naphthalene, cymol, sulphur, phosphorus, iodine, mercury, sodium, potassium, aluminium powder, calcium phosphide, antimony sulphide, lead dioxide, and manganese dioxide.

Export prohibitions have been withdrawn from petroleum, benzine, fuel oil, and chocolate.

Egypt.—The prohibition of the import of sugar is extended to February 1, 1922.

Finland.—All exports except grain and sugar are now entirely free from licence.

Among the articles the import of which is prohibited except under licence are meat extracts, cocoa powder, chocolate, sugar, molasses, glucose, honey, saffron, vanilla, vanillin, mineral waters, silk, certain papers and paper manufactures, certain leather wares, many metal wares (except platinum wares for scientific or technical use), certain wares of porcelain, earthenware and glass, toilet soap, certain essences, and essential oils.

France.—Until further notice the export is permitted, without special authorisation of organic and chemical fertilisers, ammonium sulphate, nitrates of lime and soda, dephosphorisation slag, superphosphate of lime, calcium cyanamide, and undressed hides and skins.

Recent customs decisions affect the classification of, *inter alia*, anodes of molybdenum, artificial slates or tiles of asbestos and cement, cardboard cut for packing margarine, pneumatic tyres for sidecars, anti-friction fibres of lead impregnated with plumbago, alloys of magnesium and other common metals, artificial dolomite, lanolin, nickel, and residues of vegetable oils produced in the manufacture of edible fats.

France and Algeria.—The prohibition of the export of and the export duty on spirit of turpentine have been withdrawn as from February 12.

French West Africa.—"Coefficients of Increase" have been established on certain imports and exports, including kola nuts, sugar, alcohol, salt, silver, matches, groundnuts, palm kernels, palm oil, and gum arabic.

Germany.—The import of raw cocoa, tallow, certain oil fruits, and oil-seeds is permitted without licence.

The import and export of sulphur are permitted without licence as from February 23.

Gold Coast.—The new schedule of import duties came into force on January 22. Among the articles affected are alcoholic beverages, candles, cement, lard, lard compound, lead, matches, mineral oil, soap, and sugar. Drugs and medicinal preparations recognised by the B.P. and mineral fuel oil are admitted free of duty.

Hungary.—Among the articles on which the customs duties are temporarily suspended are sugar, molasses, colza seed, rape seed, butter, lard, goose fat, margarine, fish oil, seal oil, animal and vegetable tallow, palm oil, palm kernel oil, coconut oil, pyrites, mineral oils, lignite and schist tars, and crude lead and zinc.

Italy.—The import of crude and refined mineral oils is free from restriction, but the "sales" tax is to be maintained.

The surcharge on customs duties when paid in paper currency is fixed at 300 per cent. as from February 15.

Latvia.—Recent customs decisions affect linseed, coconut oil, edible vegetable oils, margarine, cocoa butter, and carborundum wheels.

New Zealand.—Gelatinised pigmented paper to be sensitised before use with a solution of potassium dichromate may be imported duty free under the British Preferential Tariff.

Poland.—Among the articles on which the import duty is suspended until April 1 are condensed and dried milk, margarine, fertilisers, train oil, graphite, ammonium nitrate and sulphate, Glauber's salt, sulphuric, nitric, and hydrochloric acids, dye-earths, pig iron, antimony, copper ingots, lead blocks and ingots, certain kinds of paper, and cotton wool.

The customs duty has been reduced on, *inter alia*, sugar, olein, textile leather, asbestos, ammoniacal soda, soda crystals, sodium sulphide and hydrosulphite, nitro- and amino-aromatic compounds, naphtho- and sulpho-derivatives, ether, certain metals and metal manufactures, and wood pulp. On all other goods the "agio" has been raised to 1900 per cent.

Rumania.—Export duties have been removed from carbide, carbon disulphide, calcium hypochlorite and chloride, and gypsum.

Serb-Croat-Slovene State.—The import of sugar is free from all restrictions but is subject to a "monopoly" tax of 200 dinars per 100 kg., in addition to other taxes.

Tunis.—A general sanction has been given for the export of 2250 metric tons of olive oil to foreign countries.

COMPANY NEWS.

Anglo-Persian Oil Co., Ltd.—A special resolution was passed at an extraordinary meeting held on February 22 authorising, *inter alia*, (1) the conversion of the existing 6 per cent. cumulative participating preference shares into 8 per cent. cumulative non-participating first preference shares; (2) the repayment of capital to the holders thereof, in the event of liquidation, in priority to other issues, plus a minimum of 10 per cent.; (3) further issue of shares up to a maximum of £10,000,000. Sir Charles Greenway explained that the new capital was required to carry out the company's extensive programme of development. Net profits, which for the year ended March 31, 1920, amounted to £2,611,615, would not be less than £4,000,000 for the year ending on March 31 next. The company was particularly fortunate in possessing very productive wells worked at an extraordinarily low cost, and oil which contained an unusually high proportion of benzine and kerosene.

Bradford Dyers' Association, Ltd.—The address of Sir Milton S. Sharp, delivered at the ordinary general meeting held on February 28, was devoted to a discussion of the general industrial situation and suggestions for improving it. The dyeing industry is most seriously affected by the great cost of coal, and the difficulties of the textile trade in this country are very much greater than in America because some 75 per cent. of our production is for export and the present state of the exchanges almost excludes the possibility of foreign trade; in the United States the ratio of exports to production is relatively very small. The profits of the Association for 1920 were slightly higher than for 1919, but owing to the necessity of meeting the depreciation in the company's investments, mainly Government securities, the total dividend for the year, 20 per cent., is 2½ per cent. less than that paid last year.

Lever Bros., Ltd.—At an extraordinary meeting held at Liverpool on February 28 it was resolved to create £15,000,000 of redeemable first mortgage debenture stock, and to make an immediate public issue of £4,000,000 of such stock. After referring to the impossibility of raising money at the present time by issuing shares, Lord Leverhulme said that during last year the company had purchased ordinary shares in the Niger Co., J. J. Crosfield and Sons, W. Gossage and Sons, Prices' Patent Candle Co., and John Knight, and, with the exception of the shares in the Niger Co., the company had realised at a profit all the stock taken over from the others. The financial assistance given to many of the associated companies made heavy calls on the company's resources, and money was also needed for the ordinary conduct of the business. The soap trade was suffering less from the prevailing depression than many other trades, but all new development work had been stopped, and until the debentures were cleared or greatly reduced the directors would not enter upon any new undertaking or acquire further capital.

Courtaulds, Ltd.—The directors' report states that the year 1920 was one of extraordinary vicissitudes; during the greater part of it business exceeded all records and the company's productive capacity was strained to the utmost, but towards the end this situation was reversed and production had to be restricted. In particular the textile department was seriously affected by the importation of foreign silk goods. During the year the share capital of the company was raised from 4 to 12 millions sterling by the capitalisation of the reserve account. Profits, after deducting all expenses and taxes, amounted to £1,804,796, which compares with £2,280,861 in 1919 and £1,184,938 in 1918. Dividends for 1920 total 12½ per cent., free of tax, on the new capital, which is equivalent to 36¼ per cent. on the capital as in 1919, when the distribution was 30 per cent.; £200,000 is placed to reserves, against £999,993, and £383,874 is carried forward, compared with £229,077 brought in. The present value of the company's holding in the Viscose Co. is stated to exceed the valuation placed upon it in the balance-sheet. The course of business in America in 1920 was similar to that in this country, but improvement has recently set in.

GOVERNMENT ORDERS AND NOTICES.

Prohibited Exports.—The Board of Trade (Licensing Section) announces that, as from March 1, 1921, lard has been removed from Lists A and B of Prohibited Exports. Also that the following new headings have been substituted for existing headings:—

(A) Opium and any preparation thereof containing not less than 0·2 per cent. of morphine or 0·1 per cent. of diamorphine; (A) cocaine and salts thereof, and any substance containing not less than 0·1 per cent. of cocaine; (A) diamorphine and salts thereof, and any substance containing not less than 0·1 per cent. of diamorphine; (A) ecgonine and salts thereof, and any substance containing not less than 0·1 per cent. of ecgonine; (A) morphine and salts thereof, and any substance containing not less than 0·2 per cent. of morphine.

Projected New Research Associations.—The Department of Scientific and Industrial Research notifies that the formation of associations for the jute and cast-iron industries has been approved, and that the memoranda and articles of association for two others dealing respectively with aircraft and liquid fuels for oil-engines are under consideration.

Committee on Patents.—The Lord President of the Council has appointed an Inter-Departmental Committee on Patents (1) to consider the methods of dealing with inventions made by workers aided or maintained from public funds, whether such workers be engaged (a) as research workers, or (b) in some other technical capacity, so as to give a fair reward to the inventor and thus encourage further effort to secure the utilisation in industry of suitable inventions and to protect the national interest; and (2) to outline a course of procedure in respect of inventions arising out of State-aided or supported work, which shall further these aims and be suitable for adoption by all Government Departments concerned.

The sixteen members of the Committee include Mr. Kenneth Lee (chairman), Dr. H. H. Dale (Head of the Department of Biochemistry and Pharmacology, Medical Research Council), Sir Frank Heath, and the Hon. Sir Charles A. Parsons. The secretary is Mr. A. Abbott (16 and 18, Old Queen St., S.W. 1).

TRADE NOTES.

BRITISH.

Ceylon in 1919.—In spite of difficulties due to freight and rise in exchange, there was a general revival of trade in 1919. The imports, of which the U.K. supplied about 14 per cent. and British India and Burma over 54 per cent., rose in value from £11,847,784 in 1918 to £15,954,915 in 1919 (the value of the rupee being taken at 1s. 4d.). The most notable increases were in fertilisers, metals and metal-ware, and cement; of the last-named the U.K. supplied 173,119 cwt. and Japan, a keen competitor, 126,913 cwt. Exports, valued at £24,470,319, rose considerably, the chief increases being in tea, rubber, desiccated coconuts (five times the value of the export in 1918), copra, and coconut oil; the United Kingdom took over 42 per cent. and the U.S.A. over 33 per cent. (nearly double the percentage in 1918). The increase in the export of rubber, from 21,079 tons in 1918 to 44,818 t. in 1919, was partly due to stocks accumulated in 1918 owing to freight restrictions. The export of cacao decreased from 79,025 cwt. in 1918 to 54,742 cwt. in 1919, but that of cardamoms rose by nearly 50 per cent. to 561,244 lb.

In the mineral industry, there was a very sharp decline in the production of salt, the output of 319,463 cwt. comparing with 1,186,524 cwt. in the record year 1918, and representing only about half the annual consumption. Graphite mining has steadily declined since 1917, and is now at a very low ebb; 50 mines were working in 1919, compared with nearly 1300 in 1917, and the exports have decreased from over 33,000 t. in 1916 to 6671 t. in 1919. The position is viewed with anxiety, as the present slump, unlike previous slumps, is due not to lack of demand for graphite, but to supplies being obtained elsewhere. The few mines now working are producing more than the requirements, thereby adding to the existing large stocks. The attempt to revive mica mining failed, as the deposits are too small for profitable working, although some amber mica fetched good prices. The production of monazite sand on a small scale was continued at Induruwa. Materials suitable for the manufacture of Portland cement were discovered near Jaffna, and it was hoped that a cement works might be established. Sub-committees of the Industries Commission inquired into the production of hydro-electric power, for which favourable conditions are said to exist, and into glass, soap, sugar, tanning, vegetable-oil and other industries.—(*Col. Rep.—Ann., No.* 1049, *Nov.*, 1920; *U.S. Com. Rep., Jan.* 12, 1921.)

Egyptian Imports of Heavy Chemicals.—Practically all the heavy chemicals imported into Egypt are supplied by the United Kingdom, with the exception of zinc oxide, which is obtained mainly from Belgium. The imports of heavy chemicals during the first eight months of 1920 comprised:—Potassium and sodium bichromate, 202 long tons; nitrate of soda, 55,500 t.; sal ammoniac 198 t.; zinc oxide, 396 t.; caustic soda, 1500 t.; soda crystal and soda ash, 70 t.; glue, 88 t. The caustic soda imported included 33 t. from the United States, which was the only item of any importance supplied by that country.—(*U.S. Com. Rep., Feb.* 1, 1921.)

FOREIGN

The Celluloid Trade of Siam.—Celluloid goods are not manufactured in Siam, and the imports have been comparatively small during the past four years. The trade is practically in the hands of Japanese manufacturers who supplied 90 per cent. of the imports in 1919—1920, compared with 1·6 and 1·4 per cent. from the United Kingdom and the United States, respectively.—(*U.S. Com. Rep., Dec.* 31, 1921.)

Dutch Trade in Oils and Fats in 1920.—During the past year Dutch interests have acquired large holdings in German and Austrian margarine undertakings, so that in the future Holland is likely to become a clearing house for Central Europe in these trades. Although the high exchange value of the American dollar told against American exports and favoured those from Argentina, the United States nevertheless supplied four-fifths of the Dutch imports of lard, nearly all the neutral lard, about three-fourths of all other animal fats, 93 per cent. of the raw margarine, and 45 per cent. of the cottonseed oil. Difficulty was experienced in obtaining extra-quality oleo oil from the United States. Germany took 37 per cent., and Great Britain 50 per cent. of the margarine exported, and 55 and 25 per cent., respectively, of the coconut oil. —(*U.S. Com. Rep., Jan.* 26, 1921.)

Credit Organisation in the German Nitrogen Industry.—In order to encourage the purchase of nitrogenous fertiliser, the fertiliser manufacturing groups are now forming large credit organisations. It is understood that a kind of Guarantee Institute in the form of a Stickstoff-Kredit G.m.b.H. will be founded, with an original capital of 500 million marks, in which shares will be taken by the Nitrogen Syndicate and by the various associations of manufacturers, *e.g.*, the Deutsche Ammoniak-Verkaufs-Vereinigung, Bochum, the Economic Federation of German Gasworks, the Upper Silesian Coke Works, and the two firms which manufacture synthetic nitrogen products, viz., the Badische Anilin- und Soda-fabrik and the Bayerische Stickstoff-werke A.-G.

It is intended to induce farmers to purchase and accept delivery of nitrogen fertilisers in the early spring instead of in the late autumn, the Nitrogen Syndicate demanding only one-half of the purchase price on delivery, the rest to be paid by bills of exchange, which will first become due when the farmer receives the profit from his harvest. By this means no interest on the bills of exchange will be required from the nitrogen consumer for several months, and for the rest of the period he will be charged only a low rate of interest.—(*Bd. of Trade J., Mar.* 3, 1921.)

Nicaragua in 1918 and 1919.—Nicaragua, the largest of the Central American Republics, has an area of 49,200 sq. miles and a population of over 500,000. It has immense but largely undeveloped resources, including minerals (of which gold only has been worked), mahogany, dyewoods, cabinet woods, and vast stretches of uncultivated agricultural land. The production of gold, sugar, cacao, and tobacco constitute the chief industries; small amounts of soap, leather, etc., are manufactured, but only for local needs. The imports in 1918 amounted in value to £1,185,960, and included:—Cement, £4738; chemicals, drugs and medicines, £52,115; paper and manufactures of, £26,417; petroleum, £30,459. The exports, worth £1,550,988, included: Cacao, £9934; coconuts, £5460; dyewood and dyes, £2048; gold, £249,811; hides and skins, £63,266; rubber, £8523; sugar, £148,415; and silver, £45,328.

In 1919 the imports were valued at £1,582,530, of which 84 per cent. came from the United States and 9 per cent. from Great Britain; they included:—Chemicals, drugs and medicines, £89,637; cement, £6923; vegetable fibres, and manufactures of, £66,576; paper and manufactures of £31,020; petroleum, £26,087. The exports, worth £2,481,894, comprised:—Cacao, £6296; coconuts, £10,372; gold, £299,190; hides and skins, £83,748; lard, £5524; rubber, £17,181; sugar, 3847 metric tons, £123,759; and silver, £53,504; 62 per cent. of the exports went to the United States, 28 to France, and 4 to Great Britain.—(*U.S. Com. Rep., Suppl., July* 13, *Dec.* 31, 1920.)

REVIEWS.

THEORETICAL AND PRACTICAL INSTRUCTION IN ORGANIC CHEMISTRY.

A Text-Book of Organic Chemistry. *By* A. F. Holleman. *Fifth English edition, edited and completely revised by* H. Jamieson Walker *and* O. E. Mott. *Pp.* xviii+642. (*New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.* 1920.) *Price* 18*s*. 6*d*. *net*.

Laboratory Manual of Organic Chemistry. *By* Harry L. Fisher. *Pp.* 331. (*J. Wiley and Sons, and Chapman and Hall.* 1920.) *Price* 12*s*. 6*d*. *net*.

The continuous growth of organic chemistry induces in many minds a feeling of repletion which occasionally finds utterance in a protest against the addition of further organic compounds to an already enormous list. It is sometimes pointed out that many of these substances appear to have no significance in a general purview of the subject and are often only of passing interest even to the workers who synthesise them with so much persistent industry. Yet, on the other hand, there are several classical instances of organic compounds buried in neglected corners of "Beilstein" which in the long run have proved to be substances of great practical or theoretical importance.

The aromatic arsenical derivative, atoxyl, is one example of these chemical "Cinderellas," and tri-$\alpha\alpha$-dipyridyl ferrous bromide, utlised by Werner in demonstrating the asymmetric iron atom, is another.

It cannot, however, be denied that the existence of this prodigious total of organic compounds imposes a great responsibility on those who compile a students' manual of organic chemistry, where the object in view is a concise and comprehensible presentation of the general principles of the science illustrated by a judicious selection of characteristic types of organic derivatives. The skill of the compiler is to be gauged by his choice of representative examples and by his inclusion within a reasonable compass of adequate references to all the chief divisions of the subject.

That Professor Holleman's well-known text-book has fully met this acid test is sufficiently attested by the fact that the work under review is the fifth English addition, and that 33 editions have appeared in other languages. One characteristic of this revised edition is the inclusion of a large number of data dealing with physical methods of determining the molecular complexity and constitution of organic compounds or of studying the conditions under which these substances interact with one another and with inorganic reagents.

The aliphatic compounds receive adequate treatment, but possibly some compression might be made in this section in order to allow a little more space for the discussion of aromatic derivatives. The three diaminobenzenes are aromatic bases of outstanding importance, but there is only one brief reference to ortho-phenylenediamine (p. 479) and no mention of the interaction of the diamine and nitrous acid. Yet since the production of an orthodiazoimine is the simplest way of determining the constitution of an aromatic compound containing two contiguous amino-groups, this reaction is of general interest.

In an account of the formation of the two hydroxides from crystal violet by addition of alkali (p. 545) the explanation is obscured by faulty terminology. The first product, a quaternary ammonium hydroxide, is the true colour base, and this designation should not be given to an isomeric colourless substance which is not merely a base but a carbinol. On the whole, however, the nomenclature, which has been carefully edited by the translators, conforms to the system adopted by the Chemical Society, a concordance likely to be of the greatest help to English students. The increasing difficulty of separating completely the descriptions of open-chain and cyclic compounds is exemplified by the inclusion of geraniol among the unsaturated aldehydes and ketones (p. 177), whereas it seems preferable to place this aldehyde among the terpenes (p. 525). The formula for β-naphthaquinone, which was correct in the last edition, has now become distorted (p. 558), but otherwise the treatise is remarkably free from typographical errors. The work, which has been thoroughly brought up to date, is to be recmmended strongly as an unerring guide to modern organic chemistry.

Although "organic preps." are for many students the most attractive section of practical chemistry, it is doubtful whether they inculcate sufficiently those habits of tidiness, accuracy, and practical dexterity which are the best foundation of a training in the laboratory arts. When carried out in a casual and thoughtless manner, organic preparations become merely a hedonistic pastime without the mental and moral training gained in a course of chemical analysis. This danger has evidently been in the mind of Dr. H. L. Fisher in devising his course of laboratory experiments in organic chemistry, for he lays great stress on the accurate determination of carbon, hydrogen, and nitrogen in organic compounds. The author traces the gradual evolution of these methods of organic analysis, to which he has added important developments. He favours the use of an electrically heated furnace both for carbon and hydrogen estimations and for the determination of nitrogen. His employment of alumina as the absorbent for water in place of calcium chloride or concentrated sulphuric acid is an improvement likely to come into general use. These descriptions of the analytical processes occupy about one-third of the book, and attention paid to these very practical details will certainly conduce to success in organic estimations. The remainder of the treatise is devoted to laboratory experiments, including the preparation of a typical series of organic compounds, exercises on distillation, and precise determinations of melting and boiling points. The "quizzes" which form such a characteristic feature of American teaching are very much in evidence at the end of each experiment. The student who tries conscientiously to answer all these searching questions will, by the end of the course, have gathered a very considerable fund of information regarding the nature and behaviour of organic substances. The book includes many references to original literature and to other text-books. Certain of the exercises suggested are somewhat off the beaten track, such as the hydrolysis of butter, the preparation of lecithin and *l*-menthone, and several typical syntheses in the camphor series. These innovations are a welcome change from the more stereotyped preparations and lend additional interest to an original and inspiring manual of practical chemistry.

G. T. Morgan.

The Testing of Dyestuffs in the Laboratory. *By* C. M. Whittaker. *Pp.* 100. (*London: Heywood and Co., Ltd.* 1921.) *Price* 12*s*. 6*d*. *net*.

Although there were already numerous text-books on dyeing in existence, there has not previously been a treatise dealing with the subject so thoroughly from the point of view of the laboratory dyer. This book will undoubtedly be of great value to those engaged in experimental dyeing on a laboratory scale, and also to those who have to interpret the results obtained in the laboratory.

The first chapter deals in an excellent manner with the equipment and functions of a dyeing laboratory, and contains a large amount of information based on the author's twenty years' experience. The next seven chapters deal with the dyeing of various classes of dyestuffs in the laboratory, and also with the tests to which the dyeings should be subjected and the results which may reasonably be expected. The treatment is fairly full and eminently practical. A useful chapter on the dyeing of mixed fabrics and a final chapter containing miscellaneous information follow. A series of tables and a full index complete the book.

It is unfortunate that more care has not been given to a revision of the English used in this book, particularly in view of the critical review of the author's previous book (*cf.* J., 1919, 38, 35 R). A sentence such as "Enter the material cold, raise carefully to boil in half-hour, and dye at the boil half-hour" (p. 11), may be satisfactory in a laboratory note-book, but it should not be allowed to appear in a work of this nature. Again, it is interesting to note that "The water in the dyebath should have had the oxygen taken out of it by adding hydrosulphite powder conc. . . . ." (p. 63). Another notable point is the failure of the author to use hyphenated words, which leads to the frequent occurrence in the text of such words as "dyetest." In other parts of the book, the language used is certainly forcible, but by no means elegant. A point of a different character is that the author fails to emphasise sufficiently the necessity of using a freshly-prepared dye-bath as a standard in dyeing most of the anthraquinone vatcolours.

The book is essentially practical, and should be in the hands of all who wish to be acquainted with the peculiar technique of the laboratory testing of dyestuffs.

F. W. ATACK.

A SYSTEM OF PHYSICAL CHEMISTRY. *By* W. C. McC. LEWIS. VOL. II., THERMODYNAMICS. *Third edition. Textbooks of Physical Chemistry. Pp.* viii.+454. (*London: Longmans, Green and Co.* 1920.) *Price* 15*s. net.*

The importance of thermodynamics in many branches of industrial chemistry is now admitted; the work of Haber on the synthesis of ammonia is but one of the recent highly successful researches undertaken with an understanding of this branch of physical chemistry. The records of technical chemistry contain more than one example of costly blunders which could have been avoided by an elementary knowledge of thermodynamics.

The applications of thermodynamics to chemistry are so peculiar and specialised that a distinct treatment is necessary; a book written from the engineering standpoint is of little service to the chemist. The difficulties of acquiring a knowledge of the science have been greatly exaggerated and perpetuated by tradition among chemists. Two methods of treatment suggest themselves. Either particular attention is paid to general principles, their meaning and fields of application being considered broadly, or else the fundamental laws and equations are regarded as something to be got over as quickly and painlessly as possible, so that after a little mental leapfrog the far-reaching fields of special applications are entered and the consideration of details begun.

Prof. Lewis has perhaps tended to go too lightly over the fundamental parts of the subject. He has treated a large mass of detailed applications in some cases less critically than he might with advantage have done. In the lengthy discussion of Tinker's contribution to the theory of osmotic pressure, for example, he might well have pointed out that the application to intermolecular volumes of equations deduced for matter in bulk is outside the region of legitimate application of these equations. In the summary of recent American work on solutions (which is presented without any attempt to connect it with the rest of the book), the reader might have been informed that it is impossible by a really legitimate use of thermodynamics to arrive from the same set of data at two diametrically opposite conclusions.

The sections on electrochemistry, affinity, and Nernst's heat theorem are the most satisfactory parts of the book, and these should appeal especially to technical chemists. A fair knowledge of the calculus is naturally assumed, and all chemists who are so equipped will find Prof. Lewis's book both interesting and useful. Thermodynamics is not of purely academic interest, as the Haber factories in Germany eloquently testify.

J. R. PARTINGTON.

PUBLICATIONS RECEIVED.

ANTHRACENE AND ANTHRAQUINONE. *By* E. DE BARRY BARNETT. *Pp.* 436. (*London: Baillière, Tindall and Cox.* 1921.) *Price* 27*s.* 6*d.*

SILICA AND SILICATES. *By* J. A. AUDLEY. *Industrial Chemistry Series, edited by* S. RIDEAL. *Pp.* 374. (*London: Baillière, Tindall and Cox.* 1921.) *Price* 15*s.*

TABLES OF PHYSICAL AND CHEMICAL CONSTANTS AND SOME MATHEMATICAL FUNCTIONS. *By* G. W. C. KAYE *and* T. H. LABY. *Fourth edition. Pp.* 161. (*London: Longmans, Green and Co.* 1921. *Price* 14*s.*

ESTATE RUBBER: ITS PREPARATION, PROPERTIES, AND TESTING. *By* DR. O. DE VRIES. *Pp.* 649. (*Batavia: Ruygrok and Co.* 1920.) *Price* 20*fl.*

COCOA AND CHOCOLATE, THEIR CHEMISTRY AND MANUFACTURE. *By* R. WHYMPER. *Second edition, revised and enlarged. Pp.* 568. (*London: J. and A. Churchill.* 1921.) *Price* 42*s.*

AMMONIA AND THE NITRIDES. *By* E. B. MAXTED. *Pp.* 116. (*London: J. and A. Churchill.* 1921.) *Price* 7*s.* 6*d.*

PROBLEME UND AUFGABEN DER NAHRUNGSMITTELCHEMIE. *By* DR. E. EICHWALD. *Pp.* 99. (*Dresden and Leipzig: Th. Steinkopff.* 1921.) *Price* (*unbound*) 4*s.* 5*d.*

LES VERNIS. *By* CH. COFFIGNIER. *Preface by* M. HALLER. *Encyclopédie de Chimie Industrielle. Pp.* 640. (*Paris: J.-B. Ballière et Fils.* 1921.) *Price* 40 *francs.*

ANALYSIS OF PAINT VEHICLES, JAPANS, AND VARNISHES. *By* C. D. HOLLEY. *Pp.* 203. (*New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.* 1920.) *Price* 13*s.* 6*d.*

THE ASSAY OF COAL FOR CARBONISATION PURPOSES: A NEW LABORATORY METHOD. *By* THOMAS GRAY *and* J. G. KING. *Fuel Research Board Technical Paper No.* 1. *Pp.* 13. *Department of Scientific and Industrial Research.* (*London: H.M. Stationery Office.* 1921.) *Price* 6*d.*

TRINITROBENZENE AND TRINITROTOLUENE. *By* CAPT. M. KOSTEVITCH. *Introduction by* W. MACNAB. *Pp.* 38. (*London: Millard and Co.* 1920.)

UNITED STATES GEOLOGICAL SURVEY. DEPARTMENT OF THE INTERIOR. (*Washington: Government Printing Office.* 1921):—

FOREIGN GRAPHITE IN 1919. *By* A. H. REDFIELD.
SECONDARY METALS IN 1919. *By* J. P. DUNLOP.
GEMS AND PRECIOUS STONES IN 1919. *By* B. H. STODDARD.
CHROMITE IN 1919. *By* J. S. DILLER.
MINERAL WATERS IN 1919. *By* A. J. ELLIS.

CORRIGENDUM.—In the issue of February 28, p. 66 R, under Royal Photographic Society read "Dr. L. A. Levy" in lieu of "Dr. M. Levy."

THE HABER PROCESS AT OPPAU.

J. R. PARTINGTON.

The synthetic ammonia plant of the Badische Company comprises two factories: the Oppau works, forming practically a continuation of the parent works at Leverkusen, and the Leuna works near Merseburg (Halle). Oppau, which is said to have cost £15,000,000, was commenced in 1913, with a capacity of 20 tons of ammonia per day; during the war this was increased to 200 tons. The synthetic nitrogen products made at Oppau in 1918 are stated to have been:—

	Tons per annum.	NH_3 equivalent.
Ammonium nitrate	10,000	4,250
Sodium nitrate	130,000	26,000
Nitric acid	40,000	10,800
Ammonia liquor*	—	40,000

* Exported to Höchst for oxidation to nitric acid.

The Leuna works was erected since 1916, and has a capacity of 400 tons of ammonia daily. The combined output of Oppau and Leuna, 210,000 tons of ammonia per annum, is equivalent to over 800,000 tons of ammonium sulphate or 1,050,000 tons of sodium nitrate. Importation of the latter by Germany is no longer necessary. The German Minister of the Interior reported that Germany in 1916 made, by all processes, 400,000 tons of synthetic fixed nitrogen. Besides synthetic ammonia other salts, such as the chloride and nitrate, and mixed salts for fertilisers, are made at the Haber factories.

The power for both plants is derived from lignite. That for the Oppau works comes from the Ruhr district. The fuel is gasified in "Bamag" producers, 12 ft. by 25 ft., with rotary grates, a little steam being added to the air. In the Oppau works (to which the following description applies) the power plant generates 15,000—16,000 h.p. A row of 12 gas producers, each consuming 20 tons of lignite and yielding 2 million cb. ft. of gas per day, is built alongside a similar row of water-gas generators which provide the hydrogen. The latter use Ruhr oven-coke, are of the Pintsch type with rotary grates, 15 ft. by 25 ft., gasifying over 30 tons of coke to 3,000,000 cb. ft. of gas each daily. Some air is added, and the resulting gas contains about 40% H_2, 30% CO, 12% CO_2 and 18% N_2. The water gas is treated by the Badische process (B.P. 26,770 of 1912; 27,117 of 1912; 124,760 of 1918; U.S.P. 1,115,776 of 1914; 1,200,805 of 1916), in which a mixture of water-gas and steam is passed over a catalyst consisting of ferric oxide, with promoters such as chromium oxide, at a temperature of 400—500° C., when the reaction $CO+H_2O \rightleftarrows CO_2+H_2$ takes place. The catalyst remains active for two years. The catalyst plant comprises 24 units in two sections of two rows of 6 to 7 units. Each unit has two heat-exchangers and one elevated catalyst chamber; the latter is 16 ft. by 12 ft. by 10 ft. deep, with an oval cover carrying two 8-in. pipes, and contains two trays of catalyst. The heat-exchangers are 30 ft. by 15 ft. by 6 ft., and the whole apparatus is lagged, so that the reaction takes place without external heating. (The addition of a little oxygen or air to the gas has been described as a means of maintaining the temperature, a free flame burning in the catalyst chamber.) The gas issuing from the converters (in which the reaction is conducted at atmospheric pressure) contains a little carbon monoxide (according to Greenwood, "Industrial Gases," p. 163, this may be 2·5%), and must be purified from carbon dioxide, residual carbon monoxide, and hydrogen sulphide (from sulphur in the coke).

The purification (B.P. 120,546 of 1914; 9271 of 1914; 120,546 of 1918; F.P. 389,671 of 1916; U.S.P. 1,196,101 of 1916) is carried out by washing out the carbon dioxide with water under pressure (B.P. 11,878 of 1910; 124,761 of 1918); washing finally with soda (B.P. 15,053 of 1914) is not used. Carbon monoxide is taken out by washing with ammoniacal copper solution and hot caustic soda solution under high pressure (B.P. 1759 of 1912; U.S.P. 1,126,371 of 1915; 1,133,087 of 1915; J. Amer. Chem. Soc., 1921, **43**, 1), which also takes out hydrogen sulphide. The copper solution contains excess of ammonia (not less than 6%) to prevent iron being attacked; the soda solution may contain 25% NaOH, and is brought in contact with the gas at 260° C. under 200 atm. pressure.

In the purification from carbon dioxide the gas, carried by a 3 ft. main from the converters, is compressed at 25 atm. and passed to the bases of eight steel towers, 30 ft. by 4 ft., packed with rings, into the tops of which water at 25 atm. pressure is injected by circulating pumps. The water issues charged with carbon dioxide; it is passed through Pelton wheels, in which 60 per cent. of the power is recovered, and the carbon dioxide evolved is collected. It is important that the amount of carbon dioxide recovered should be more than sufficient to convert all the ammonia produced into sulphate by the gypsum process, or into chloride by the ammonia-soda process. The gas is now passed through steel bottles which act as spray catchers to the high-pressure plant. Here it is brought to 200 atm. and delivered to the carbon-monoxide purifiers.

This plant consists of 16 towers of special steel, each in one piece, 25—30 ft. high by 2 ft. 6 in. external diameter, with flanged ends, and packed with Guttmann balls. In the first eight of these an ammoniacal copper formate solution is circulated, in the remainder caustic soda ($CO+NaOH=H.COONa$). The liquids are circulated by eight hydraulic pumps of forged steel, 200 h.-p. total, and the ammoniacal copper solution, which absorbs ten times its volume of carbon monoxide, is passed down a 40 ft. tower, where the gas is released and collected. Spray traps in the form of vertical steel bottles are placed under these towers. The presence of 0·01 per cent. of carbon monoxide in the final gas is said to be injurious.

The purified hydrogen (with some nitrogen from the air mixed in the water-gas operation) is now passed to the catalyst plant by a high-pressure main. The nitrogen content is brought up to the ratio $N_2:3H_2$ from a Linde plant, and the gas is dried.

The catalyst plant, in which the mixture is converted into ammonia, consists of fifteen steel bombs, each comprising two straight flanged sections, each 19·7 ft. long and 31·5 in. internal diameter, the walls being 7 in. thick. These are bolted together and the covers are held on by fifteen 4-in. studs. The walls are perforated at intervals of 1 ft. with ¼-in. tapering holes. Inside is a steel liner, making a gas-tight joint with the ends (U.S.P. 1,188,530 of 1916; D.R.P. 254,571 and 256,296 of 1911), and probably also a refractory lagging and a support for the catalyst, the internal diameter of the catalyst space being 19·75 in. The outer walls are heavily lagged, and reach 300—400° C.; the catalyst is at 600° C. The temperature is maintained by heat-exchangers, consisting of forged steel tubes, 19·7 ft. long and 15 in. external diameter, fitted internally with nests of ⅝-in. steel tubes autogenously welded into end-plates. Each catalyst unit (costing 100,000 marks) is mounted vertically with its heat-exchanger inside a brickwork compartment with strong iron doors and planking, with a little of the bomb projecting above. Starting is effected by adding oxygen (which does not come into contact with the catalyst) (D.R.P. 359,870 of 1911) or by electrical heating (U.S.P. 1,202,995 of 1916). An iron catalyst with a promoter (possibly molybdenum) is used (D.R.P. 265,295 of 1912; U.S.P. 1,188,530 of 1916).

The gas is circulated through the catalyst; argon and methane may accumulate up to several per cent.; 10 per cent. of the gas is lost by leakage.

The ammonia is removed from the gas by solution in water under pressure (D.R.P. 235,421 of 1908; 270,192 of 1912); liquefaction (U.S.P. 1,202,995 of 1916) is not economical. Three water-injector pumps are connected with nine sets of absorbers, each consisting of three water-cooled steel spirals set vertically, the upper spiral being 60 ft. above ground. The gas passes down the lowest spiral, rises to the top of the second spiral and passes down this; and similarly with the third spiral. Water flows down all the spirals by gravity. A solution containing 25% NH_3 is obtained. The gas is dried and sent back to the catalyst system.

The personnel at Oppau comprises 1500 labourers, 3000 mechanics, 350 clerks and 350 chemists. The fuel requirements (McConnell, J. Ind. Eng. Chem., 1919, **11**, 837) are 1750 tons of lignite (400 for gas engines, 1000 for steam for hydrogen plant and 350 for power plant) and 500 tons of coke (for hydrogen) per day. The daily cost of labour is £2300, of fuel £2300, and working expenses, interest, etc., £6700. The progress made since the laboratory experiments of 1906 to this immense factory in 1913—a period of only seven years—represents one of the greatest technical achievements of all time. Of particular interest is the association of the synthetic ammonia plant with the ammonia soda process.

* * *

The only other synthetic-ammonia factory outside Germany is the United States Nitrate Factory No. 1, at Sheffield, Alabama, erected during the war. This utilises the modified Haber process of the General Chemical Co. (U.S.P. 1,141,947—8 of 1915; B.P. 120,546 of 1918; 124,760—2 of 1918). The catalyst is prepared by impregnating pumice with nickel or ferric nitrate, heating to 550° C., reducing at this temperature with hydrogen, and treating with sodium and ammonia gas at 450° C. Sodamide is formed in the spongy metal, and the mass acts at 500° C. under 70 atm. (a much lower pressure than that used in Germany). The plant was designed to produce 21·5 tons of ammonia daily, and cost $13,000,000; the synthetic ammonia section cost $7,000,000, but requires another million for completion. Three units are installed. The plant was operated for a short time, but great difficulties were encountered owing to faulty design, and the factory was closed in the beginning of 1919, about three months after work began. The process developed into a straight blue water-gas make, followed by addition of air in the hydrogen converters for flame combustion to maintain the temperature. Caustic scrubbing was discarded as giving too much sediment and ammoniacal cuprous carbonate alone used at low temperatures. The catalyst furnaces, which were operated at 100 atm., were similar to the well-known Badische converters for sulphur trioxide, but much thicker and capable of withstanding pressure. The catalyst was contained in the internal battery of iron tubes. Self-heating was not attained (R. S. Tour, J. Ind. Eng. Chem., 1920, **12**, 844).

APPOINTMENT OF COMMITTEE UNDER THE DANGEROUS DRUGS ACT.—The Home Secretary has appointed a committee of five to consider objections to, and to advise concerning possible modification of, the draft Regulations issued under the Dangerous Drugs Act.

THE MANUFACTURE OF HAND-MADE FILTER PAPER.

J. BARCHAM GREEN.

The following brief notes on the manufacture of hand-made filter paper will be of interest in view of the circumstances that the manufacture was practically initiated in this country during the war, and that English papers have now to a great extent replaced the foreign-made papers which were previously in general use.

The foundation of a good paper is suitable rag; old muslin curtains have been found to give the best results for fast filtration, but where strength is required a strong rag, like best canvas or old linen shirts, is often added. After the rags have been sorted and cut by hand the dust is shaken out in a rotary machine made of wire gauze, then buttons and other foreign matter are picked out, and the rag is boiled with alkali for 1 to 4 hours. Opinions differ as to whether alkali should be used, but 2 to 3 lb. per cwt. of dry rag should not be harmful if the boiling is done without high pressure. The boiled rag is reduced to pulp in water in a beater provided with bronze knives fitted on to a solid drum, which can be lowered until the knives touch a grooved bronze plate. Paper that filters quickly is obtained by reducing the proportion of rag to water and increasing the speed of the beating, but much depends on the skill with which the roll or cylinder is adjusted to the grooved plate; when the beating has been done very quickly the finished sheet will sometimes show the threads of the muslin rag used. The pulp is usually bleached with chloride of lime, the excess of which must be completely washed out with pure water. After beating, the pulp is strained to remove knots and lumps, run over magnetic separators to remove any particles of iron that may be present, mixed with water, and then run into a vat, either of stone or of iron lined with lead. A layer of pulp is obtained by dipping a mould covered with wire gauze into the vat, removing it and allowing the water to run off; the layer is pressed on to a felt and a pile of alternate layers of pulp and felt is put under a hydraulic press. The pressure applied largely determines the texture of the paper; if it be too great a hard paper that filters slowly will be produced. The paper is dried either on a steam-heated cylinder or by hot air, sorted, and stocked as sheets or circles. Circles are cut from a wad of about 100 sheets by means of a steel cutter, and when large circles of, say, 50 cm. diameter are cut from a sheet of 50 cm. square, the corners are wasted if they cannot be sold. This explains why the price of circles is apparently out of proportion to their actual size.

In the manufacture of filter paper particular attention has to be paid to its purity, strength, filtering speed, and ash content. To obtain a pure paper neutral spring water, free from organic matter and containing little calcium bicarbonate, must be used. When testing for strength the paper must be wet; the strength when dry is often very different from the strength when wet, especially in the case of very strong papers intended for use with a filter pump.

Roughly speaking, the stronger a paper the more slowly it filters, and to obviate this difficulty the manufacturer selects a very strong fibre, such as new linen, and beats it very rapidly to a pulp; otherwise it becomes slimy (if beaten long enough it would be converted into hydrocellulose and produce a sheet of parchment which would be waterproof). Strength can also be obtained by using thicker paper, but as this filters slowly some makers produce a paper with a crinkled surface. Such a surface cannot be given to hand-made papers, but a better result is obtained by folding the paper fan-wise to produce a fluted surface. The speed of filtration is ascertained by finding the time required for pure water to pass through the paper at a definite temperature. Liquids containing suspended solids, such as barium sulphate, are less suitable, as mistakes may be made in preparing them; they must, however, be used in testing the clarity of the filtrate.

Before the war certain foreign firms sold "ashless" papers having a certain ash content, and their figures were usually taken as correct; but when the manufacture was started in this country it was found that the ash content of these papers varied very greatly and that it was seldom as low as the figure stated. English papers, as now made, usually contain a little less ash than is indicated on the wrapping. English manufacturers now produce a large variety of papers among which types can be found suitable for many special purposes; and the makers are usually prepared to satisfy individual requirements. Complaints of bad quality often arise from the use of papers for purposes for which they are unsuited; they could in most cases be avoided by careful reference to the manufacturer's catalogue before purchasing.

THE MANUFACTURE OF SULPHURIC ACID IN THE UNITED STATES.

Bulletin 184, recently issued by the U.S. Bureau of Mines, contains a considerable amount of information relating to the manufacure of sulphuric acid in the States. In 1865 only some 37,500 tons of acid, calculated as 100 per cent., was manufactured; in 1880 this had become 265,630 tons, and in 1900 over one million tons. The table which follows gives the production for the last six years before the armistice. It should be noted that all quantities have been calculated into the equivalent of 100 per cent. acid, as in the report different ways of stating the strength are given:—

Year.	Concentrated acid produced as 66° B. Tons.	Total production a strengths calculated to 100% H_2SO_4. Tons.
1913	810,000	2,239,930
1914	720,000	2,280,000
1915	1,160,000	3,173,800
1916	1,930,000	3,938,000
1917	2,100,000	4,505,000
1918	2,400,000	4,661,300

Towards the end of 1918 the producing capacity was approximately 6 million tons, about 40 per cent. of the total being contact acid. Government and explosive manufacturers' plants accounted for about 22 per cent. of the total production, the rest being fertiliser and general chemical works plants. When the armistice was signed work was stopped at once on plant in course of erection designed to produce some 450,000 tons per annum.

The distribution of the factories is described by means of a map, tables and a list of the individual works, the greater number being in the Eastern and South-eastern States.

The proportion in which the various industries were using acid in 1918 is shown below:—

	Per cent.
Explosives (military)	33·5
do. (domestic)	2·5
Fertilisers (superphosphates)	28·4
Oil refineries	8·8
Chemicals, drugs, and ammonium sulphate	9·9
Steel pickling and galvanising	9·3
Fabrics, textiles, etc.	1·3
Paints, lithopone, glue, etc.	1·4
Metallurgical, including storage batteries	3·9
Miscellaneous	1·0
	100·0

The normal requirements of the United States are estimated to be equivalent to about three and a half million tons of 100 per cent. acid, of which about one-half is required for superphosphates, so that a considerable margin of producing capacity exists.

The influence of the war on the proportions of the various sources of sulphur as raw material is well illustrated in the next table:—

	Percentage of total quantity. 1914.	 1917.	 1918.
Brimstone	2·6	32·6	48·0
Pyrites (Spanish)	50·0	22·9	7·6
do. (domestic, including coal brasses and pyrrhotite)	15·8	11·8	12·7
do. (Canadian)	7·9	6·9	7·5
Zinc ores	13·2	18·1	16·1
Waste gas from copper smelters	10·5	7·7	8·1
	100·0	100·0	100·0

Practically all the brimstone was obtained by the Frasch process of mining from the coastal plain deposits of Louisiana and Texas. Owing to the ease of handling and to the cleaner gas obtained, brimstone is considered to be worth 3 to 4 cents more per unit than a 40 per cent. pyrites if the acid maker gets nothing for his burnt ore. The price of Spanish pyrites rose during the war to as much as 30—35 cents per unit, but it has since fallen again, the quotation in July last being 16 cents. Much attention has been given to the recovery of pyrites from waste coal, and it is concluded that the coal mines of the Eastern States could produce over 1½ million tons of pyrites per year with an average content of 40% sulphur.

All the zinc works of Illinois, Indiana, Ohio, Pennsylvania, and West Virginia are producing acid, but those of Kansas, Missouri, and Oklahoma have not yet done so. At the copper works some very large plants exist, that of the Tennessee Copper Co. being capable of producing acid equivalent to over 625 tons (of 100%) per day.

Both the chamber and the contact systems are described at considerable length, and the following are the chief points noticeable about the American practice:—Owing to the large use of brimstone, special devices for burning this material have been developed, among which may be mentioned the Tromblee and Paul rotary and the Vesuvius vertical burners; Herreshoff and Wedge types of mechanical fine pyrites roasters seem to be most in favour, and Hegeler, Spirlet, and Wedge (muffled) are in use for zinc ores. The Cottrell electrical precipitator has given satisfaction both as a dust eliminator for burner gas and as a condenser for fumes from acid-concentration plants. Towers constructed of acid-proof brick and cement without a lead casing are in use, and steel framing is replacing wood as a material for supporting the chambers. Much attention appears to be given to intermediate towers of various types, and a full description is given of the "Anaconda Packed Cell" system, in which the chambers are replaced by towers packed with special tiles.

In metallurgical and other works where the composition of the burner gas is likely to vary the Fairlie system of analytical control is advocated. Concentration is effected in cascades, Kessler plants, and in tower systems of local design, such as the Kalbperry and the Chemico Concentrators, but no mention appears to be made of the Gailliard system. The Mannheim, Badische, Grillo-Schroeder, and Tentelew contact systems are all in use and are described and compared, as are also the various types of gas-cooling towers, dust filters, drying and absorbing systems, and the methods of preparing and revivifying the catalysts.

Comparisons of pre-war and post-war costs of plant and acid for both chamber and contact systems are given, and the report concludes with a short account of the methods of utilising burnt pyrites and nitre cake.

SOCIETY OF CHEMICAL INDUSTRY.

ANNUAL MEETING, 1921.

With reference to the cancelled sailing of the s.s. "Megantic" from Liverpool to Montreal on August 13, it has been decided to postpone for another month the choice of the steamship to convey the presidential party.

The following communication has been received from the Committee of the Montreal Section:—

Plans are rapidly maturing for the Annual Meeting of the Society to be held in the latter part of August. A strong committee of the Montreal Section is arranging an elaborate programme of great interest to visiting members, details of which will be announced later. The Windsor Hotel, situated in the upper heights of the city of Montreal, one of the beauty spots of the Canadian metropolis, has been chosen as headquarters. A unique feature of Montreal is the glimpses it affords of the old French *régime* side by side with examples of the modern spirit of commercialism, *e.g.*, the historic Bonsecours Church with its immense statue overlooking one of the world's most modern harbours, where huge grain elevators give evidence of one of the main sources of the country's wealth. Plans are being made for an extended trip in Canada which will provide opportunities to inspect typical Canadian manufactures and to view the primitive beauty of forest and stream. As the steamships plying between England and Montreal touch at Quebec, a few enjoyable hours may be spent in rambling round the ancient capital and its environs so rich in historic interest. It is considered none too early for members to begin making their plans with a view to attending what should prove to be a particularly interesting meeting.

MARCH MEETING OF COUNCIL.

At the monthly meeting held on March 11, the President moved a vote of condolence to the family of the late Lord Moulton, which was carried unanimously, and the Secretary was asked to attend the memorial service. Sir William Pope intimated that the nomination of the president for 1921–22 would be considered at the next meeting, also the nomination of vice-presidents and the election of hon. treasurer and hon. foreign secretary. Thirty-nine new members were elected (21 home, 4 colonial, 3 Indian, and 11 foreign), and Mr. John Spiller, an original member who has done valuable work for the Society over a long period of years, was unanimously elected an honorary life member.

The Hon. Treasurer reported that the sum of £13,124 had been received as proceeds of the realisation of the non-trustee securities of the late Dr. Messel's bequest, and it was resolved to invest the whole of this sum in 5 per cent. War Loan, 1929–47. It was also stated that the Finance Committee would in due course prepare a statement showing how the legacy had been dealt with. A separate account will be kept of the monies derived from this bequest.

On the report of the Publications Committee, it was decided to authorise the reprinting and circulation of approved articles from the Review bearing upon public policy, as occasion required and due regard being paid to expense; and it was agreed that the Council, through the Government and Parliamentary Committee, should associate itself with the Pharmaceutical Society and other interested bodies in opposing the regulations recently issued under the Dangerous Drugs Act. The report of the Edinburgh and East of Scotland Section was presented to the Council.

CHEMICAL ENGINEERING GROUP.

A conference on "Waste Waters" was held at the Technical College, Huddersfield, on February 24. Dr. H. H. Hodgson, who presided in the absence, through illness, of Mr. J. A. Reavell, commented upon the importance of the work done by the Society and the Group in spreading useful knowledge applicable to the development of industry, and complimented the Group upon its enterprise in holding its meetings in various parts of the country instead of in one locality, as was the practice of many societies. He then called upon Mr. E. V. Chambers to read his paper on "Plant for the Purification of Industrial Waste Waters, with Recovery of Useful By-products."

The woollen industry yields three classes of effluent—that from washing the raw wool, that from scouring yarn and pieces, and the effluent from the dyeing process. In each case the effluent is passed through a rotating circular screen to remove fibre, and the subsequent treatment, which is partly mechanical and partly physical, varies with the nature of the liquid to be purified. Suspended solids are eliminated in settling tanks by gravity or centrifugal filters, and colloidal matter is similarly removed after pre-treatment of the liquor with alumino-ferric or other precipitant. The author then described—first generally, then in detail—the process for purifying the effluent from a woollen piece-scouring factory, which consists, briefly, in removing the grease by saponification with alkali, and then treating the liquor for recovery of soap, soda, and oil. A typical plant with a capacity of 22,000 galls. a day of strong scouring liquor was described and illustrated. The next portion of the paper dealt with the treatment of general effluent to produce a non-polluting discharge into a stream. In its broad outlines the scheme is the same as that mentioned above, but additional factors have to be taken into account, and labour charges must be cut down to a minimum. A good example of the feasibility of conducting effluent treatment as a source of profit is shown by the recovery of wool grease, lanolin, and potash from wool scourings; it is estimated that nearly 50,000 tons per annum of wool fat and about 20,000 tons of potash (reckoned as carbonate) are available for recovery in this country. The successful Smith-Leach process was described and also the modern centrifugal method which yields wool fat of twice the value and at half the cost of the "acid" or chemical process. Details were given and photographs and diagrams shown of a plant for carrying out the centrifugal process. The treatment of the pickling liquor obtained in various metal-working factories, *e.g.*, wire-drawing works, where it contains about 0·5 per cent. by weight of free hydrochloric acid and about 20 per cent. of ferrous chloride, consists in adding enough sulphuric acid to liberate all the combined chlorine as hydrochloric acid and in obtaining this by distillation, the iron being recovered as ferrous sulphate. The operation of a typical plant was described and explained.

Mr. O. Reynard, of Bradford, said that he had found that the centrifugal method of extracting wool fat was very successful from the qualititative standpoint, but that he had only been able to recover about 40 per cent. of the fat instead of 60—75 per cent., as mentioned by the author. The difficulty probably lay in the existence in the emulsion of the wool fat in two states of "fineness"; the coarser was rapidly removed and represented the 40 per cent. extraction, but the finer could not be completely separated. Mr. Chambers, in his reply to Mr. Reynard and others, said that the results given in his paper had mostly been obtained on a commercial scale at works in Huddersfield. The "frothing" process had been tried but had invariably led to bacterial decomposition of the wool fat unless the air had been sterilised or filtered before use. The "churn" process had also been experimented with, but it was only partially successful and far less effective than the methods described in the paper. No trouble had yet been experienced from the presence of arsenic in the acid recovered from waste pickling liquor (*cf. s.*), as the design of the plant obviated this.

The full report of the meeting will be published in Volume III of the *Proceedings* of the Group.

NEWS FROM THE SECTIONS.

TORONTO.

"The Story of Petroleum" was the subject of an address delivered by Mr. W. A. P. Schorman, of the British-American Oil Co., on January 28. The chairman of the Section, Mr. M. L. Davies, of the Standard Chemical Co., presided, and there was a very large attendance of members and visitors. The address was illustrated by kinematograph pictures showing the activities of the oil industry from the drilling and shooting of the oil wells to the distillation processes in the refineries. Referring to the recent discovery of oil at Fort Norman in North-West Canada, Mr. Schorman said that he believed that oil had been found there in paying quantities, but actual figures were not yet available. The oil that had been found would flow freely at a temperature well below −60° F. and did not solidify above −90° F. This was a very valuable characteristic of the oil, for the temperature in that territory often reached −60° F. during the winter. Another very valuable circumstance was that the oil yielded over 50 per cent. of the lighter hydrocarbons, so that when the territory was sufficiently developed a large supply of gasoline should be secured. The discovery of the oilfield was made by a Canadian geologist, Mr. Boswell. Mr. C. B. Parsons, president of the British-American Oil Co., spoke optimistically of the development of the oil industry in Canada, and expressed his belief that oil would yet be found in other more accessible parts of the Dominion. The need for developing an oil industry in Canada was very great.

OTTAWA.

On December 16, 1920, about 40 members of the Section assembled to see a kinematograph film entitled "The Story of Coal," kindly lent by the Sullivan Machinery Co., of Chicago. The film showed the mining of coal in one of the model mines in Pennsylvania and many views of plant used in manufacturing mining machinery.

At a meeting in the Carnegie Library, Ottawa, on January 13, Mr. E. Stansfield presiding, a discussion arose on the Bill to be introduced in the Ontario Legislative dealing with the legal status of the engineering profession, and it was decided to convene a meeting of the chemists of Ottawa to discuss the subject more fully. Dr. R. S. Stevens then gave an address on "Vitamins" in which he traced the history of the development of this branch of biochemistry and summarised our present knowledge of the subject. Colonel J. T. Janson followed with an address on the more chemical aspects of these food factors. Sixty-five members and guests were present at this meeting, including medical men and representatives from the University Women's Club.

A joint meeting was held with the Engineering Institute of Canada on February 10, the chair being taken successively by Lt.-Com. C. P. Edwards, chairman of the Ottawa Branch of the Engineering Institute, and Mr. E. Stansfield, chairman of the Section. The attendance numbered 65. Capt. E. M. Dawson read a paper in which he reviewed the cement industry and described recent work on super-cements. He outlined the processes involved in the manufacture of Portland cement, dealt more in detail with the methods of testing raw materials and products, and finally reviewed the improved methods of making cement involving the use of what he termed "cata-cell," a substance which is introduced into all super-cements. He claimed that super-cement is superior in every way to Portland cement, because it is waterproof and more durable, owing to the fact that a "cata-cell" promotes more complete hydration. A long discussion followed.

LONDON.

A meeting of the London Section was held at Burlington House on March 7, Mr. Julian L. Baker presiding. Two papers were presented, the first of which was by Dr. J. C. Drummond on "Factors Influencing the Food Value of Lard and Lard Substitutes." It has often been stated that animal fats contain the fat-soluble vitamin A, and that vegetable fats are deficient in this substance; no such general rule, however, can be laid down since it has not hitherto been identified in lard. Two causes contribute to the low vitamin content of lard:—(1) The diet usually given to pigs in this country is often deficient in vitamin A; and (2) during the process of lard manufacture much of the vitamin, if present, is destroyed owing to exposure of the fat to oxygen at high temperature. If pigs are fed with a material rich in vitamin, such as grass or cod-liver oil, not only do they grow much better, but their fat contains plenty of this important factor. It would appear that the destruction of the vitamin is due less to the high temperature to which the fat is subjected in the subsequent refinement of the lard than to the action of atmospheric oxygen.

The second paper, entitled "The Stability of Benzoyl Peroxide," was read by Dr. R. C. Farmer. Benzoyl peroxide is of industrial interest as an oxidising agent, and has been used for several purposes under the name of "Lucidol." It is a powerful antiseptic, and has been used for the treatment of burns and ulcers. It acts as a drier for linseed and other drying oils, and has been used to a small extent as an explosive. The substance is unstable whether it be crude or pure, but immunity against explosion can be attained by mixing it in the wet condition with excess of salt and then drying.

NEWCASTLE.

At a joint meeting of the Section with the Cleveland Institution of Engineers, held at Middlesbrough on March 7, Mr. C. F. Tidman, in a paper on "Alcohol from Coke-oven Gas," described further experiments which had been carried out at Skinningrove on the absorption of ethylene by sulphuric acid and its conversion into alcohol.

In a brief historical introduction it was stated that Hennell had published papers in 1827-28 on the production of alcohol from ethylene, and that he therefore deserved to rank with Wöhler as the first to produce an organic compound from inorganic constituents. A series of laboratory experiments was described which showed that the ethylene was most rapidly absorbed by sulphuric acid of 95·4% at about 80° C. with turbulent contact; and it was deduced that nine towers, each 10 ft. diam. by 80 ft. high, would be required for the absorption of the ethylene contained in the coke-oven gas at Skinningrove, where 800 tons of coal are carbonised daily; of these nine towers the volume of six would be occupied by packing material. In further laboratory experiments it was observed that when ethylene and sulphuric acid are shaken in a flask, the addition of silica increases the absorption by about 5 per cent.; and it was concluded that whether absorption towers or mechanical washers be adopted for large-scale use, it should be possible to remove 70—80 per cent. of ethylene from the coke-oven gas by allowing a contact of 2½—3 minutes between it and the sulphuric acid. Mr. E. Bury found that 18 per cent. of the sulphuric acid put into circulation was available for ethylene-absorption, *i.e.*, that a 95% acid would continue to absorb until its concentration was reduced to 77%; further work has shown that the absorption can be carried still further when a mechanical agitator is used. The great advantage of a mechanical washer over a tower-scrubber system is the much smaller size of the plant required.

The recovery of the alcohol from the reaction mixture was found to be best effected by distillation with steam under reduced pressure, the bulk of the alcohol being obtained as a 15% concentrate. After rectifying up to 87%, it gave good results when used as motor fuel. The alcohol obtained by this method contains various impurities, including diethylene disulphide and a yellow oil of unknown composition, the former of which is due to the action of the hydrogen sulphide present in the coke-oven gas, and a method of eliminating it has been worked out which consists in treating the coke-oven gas with a large excess of sulphur-dioxide solution on the counter-current system, the excess of dioxide being removed by subsequent scrubbing with water and used over again. That pure alcohol can be made from coke-oven gas is certain, but it has yet to be done on a commercial scale. By using purified coke-oven gas and alcohol recovered by distillation under reduced pressure, it should be possible to obtain an 80% conversion of the absorbed ethylene, and by using an acid stronger than 95% it should be possible to obtain a higher ethylene absorption than 70%.

Prior to the meeting, at which over 150 were present, a visit was made to the By-product Works of Messrs. Sadler and Co., Ltd., Middlesbrough.

EDINBURGH AND EAST OF SCOTLAND.

The hon. local secretary's report on the work of the session, which was read at the annual meeting held on March 8, records the holding of six meetings attended by an average of forty members. Twenty new members joined the Section, twelve were lost by deaths and resignations, and ten by transference to other Sections; the total membership to date is 157. The Committee has now lost the able services of the chairman, Dr. D. S. Jerdan, who is leaving to take up an appointment in Brussels, and Dr. A. C. Cumming is also leaving Edinburgh to engage in chemical manufacturing work in Liverpool. The thanks of the Committee are accorded to the Council of the North British Branch of the Pharmaceutical Society, and to its secretary, Mr. J. Rutherford Hill, for allowing the Section to use the Society's hall for its meetings.

BIRMINGHAM.

A paper on "Colour in Water: Its Nature and Removal" was read by Mr. Joseph Race at a meeting held on March 10 at Birmingham University. The paper was confined to a consideration of brown peaty waters which are found in various countries. The properties of these waters were fully described, and a *résumé* was given of the evidence of the colloidal nature of the colouring matter, together with details of experiments illustrating the practical importance of the behaviour of the colloids on the addition of an electrolyte, such as alum. It was stated that the effect of alum on coloured waters had been intensively studied in America, because the colour in many waters in that country is often very high and the water consumption is four to five times that in England. The effect of these causes on filter design was indicated. The study of alum flocculation has led to the adoption of the "excess alum" method, and this has resulted in considerable economies being effected at many plants.

Removal of colour by electrolytic methods was also discussed and a detailed description was given of an experimental plant in which aluminium electrodes were employed. The results showed that when precipitation is effected in this manner the amount of aluminium consumed is very much less than when alum is used; also that the alkalinity, and consequently the carbonic acid content, remain unchanged. The costs, calculated on a run of 20,000 gallons, were given, together with analyses of the various precipitates obtained with both aluminium and iron electrodes.

An informal dinner for members of the Section —the first since 1913—was held in the White Horse Hotel on March 14, and was attended by about 30 members.

MANCHESTER.

The annual supper of the Section was held on March 10 in the Albion Hotel, Manchester. Mr. John Allen presided, and about 130 members and friends were present. On the announcement of the death of Lord Moulton all present rose in silence to express their regret. An informal musical programme occupied a portion of the evening.

MEETINGS OF OTHER SOCIETIES.

INSTITUTE OF METALS.

The Spring Meeting of the Institute of Metals, held at the Institution of Mechanical Engineers on March 9 and 10, was presided over by Sir George Goodwin and was well attended. The subject of season-cracking in brass was brought forward in a paper by Messrs. H. Moore, S. Beckinsale and Miss Mallinson, who produced evidence, from the examination of a very large number of cold-worked articles at Woolwich, in favour of the view that the cracking is caused by chemical corrosion, especially by traces of ammonia, acting selectively on the intercrystalline material. The presence of initial stress is essential to the development of season-cracks, and the composition of the alloy is of secondary importance. The discussion showed that cracking may sometimes occur in new rods, especially in winter, under conditions which seem to exclude the possibility of corrosion, and it was also pointed out that the phenomena of fire-cracking and season-cracking are essentially similar, although the former are almost certainly not of chemical origin. Fortunately, the liability to crack is removed by low-temperature annealing, which is without any softening effect on the metal. As is usual when this subject arises, a part of the discussion resolved itself into a duel between the defenders and the opponents of the hypothesis of an amorphous intercrystalline cement. The whole subject is to be considered at the forthcoming joint meeting arranged by the Faraday Society. The same authors also dealt with another form of intercrystalline brittleness, produced in copper by the action of reducing gases. This action is due entirely to the presence of cuprous oxide, and copper which has been thoroughly deoxidised is immune. The addition of a small quantity of zinc is particularly recommended for this purpose, and attention is called to the useful properties of an alloy of copper containing from 2·5 to 3% of zinc, which works well hot or cold, and will stand severe deformation. It casts well, and is not subject to season-cracking.

Prof. C. A. Edwards and Mr. A. M. Herbert described measurements of the dynamic hardness of copper-zinc and copper-aluminium alloys at high temperatures, showing that critical temperatures in such alloys are more readily revealed by dynamic testing than by the slow application of a tensile stress. An interesting point mentioned in the discussion was that workmen when heating billets of such alloys determine their approximate temperature by poking with a pointed rod, a rough application of a dynamic hardness test. Mr. P. H. Brace, of Pittsburgh, communicated an account of the metallurgy of calcium, describing the modern form of electrolytic cell, using pure calcium chloride as the electrolyte, and tabulating the principal properties of the metal. It is possible that calcium may find more extended uses in metallurgy. In the absence of Prof. H. C. H. Carpenter, through illness, the further paper on the recrystallisation and crystal growth in metals, in collaboration with Miss C. F. Elam, was read by the latter. The new results deal mainly with aluminium, and it is shown that the complete destruction of the crystal structure, often described by previous workers as resulting from severe cold-working, does not take place, and that the confused micro-structures so often recorded are due merely to the difficulties of etching this material. The birth of new crystals in the metal during annealing is clearly shown, and a comparison with brass and with aluminium-zinc alloys proves that the new crystals arise in the boundaries of the old. The remaining paper, by Dr. J. L. Haughton, continued his earlier work on the revision of the copper-tin system, and included a diagram covering the range from 35 to 100 per cent. of tin. Even now, some of the transformations are difficult to understand, and the author's careful determinations of electrical resistance at varying temperatures indicate changes of which there is at present no explanation.

THE CHEMICAL SOCIETY.

The Annual General Meeting was held at Burlington House on March 17, when the following elections were announced by Sir J. J. Dobbie:—*President:* Sir James Walker; *Vice-Presidents:* Prof. H. E. Armstrong, Sir J. J. Dobbie, Prof. W. H. Perkin, Sir W. J. Pope, Dr. A. Scott, Sir W. Tilden, Prof. F. G. Hopkins, F. S. Kipping and J. F. Thorpe. *Ordinary Members of Council:* Prof. J. S. S. Brame, C. H. Desch, T. S. Patterson, Drs. T. Slater Price, R. Robinson, N. V. Sidgwick, and Messrs. E. V. Evans, H. B. Hartley, and W. Rintoul. The Longstaff Medal was presented to Prof. J. F. Thorpe, and Sir J. J. Dobbie read in abstract his presidential address on the value of the study of the history of chemistry.

In the evening the Anniversary Dinner was held at the Hotel Cecil, Strand, W.C. 2. Among the guests were the Right Hon. Sir Alfred Mond, the Right Hon. Lord Bledisloe, Prof. C. Moureu (vice-president of the Société Chimique de France), Sir J. Dewar, Sir W. Tilden, Prof. C. S. Sherrington, and the Hon. Mr. Justice Sargant. The number present was 224.

After the loyal toasts Sir Alfred Mond, in proposing the Chemical Society, referred to its distinguished past presidents, and expressed the fear that the spirit which drove Hofmann from England and which helped to drive the dye industry to Germany was not yet extinct. "Science and research are not the fads of the few or the follies of the aged, but vital necessities to the existence of the nation." The exhaustion which followed the Napoleonic wars was greater than that which existed today, and the key to recovery lay in some great improvement in our methods of production, some great discovery as fundamental and far-reaching as that of the steam engine in its epoch.

Sir J. J. Dobbie, in reply, outlined the more important changes and developments which had occurred in the Society during the past two years. In particular, he emphasised the reformation of the charter on a more democratic basis, the admission of women to the fellowship, and the financial stringency. The number of fellows had increased from 3205 in 1914 to 3569 in 1919, and last year there were 3721; but more important than this growth in membership was the recent increase in the number of papers printed in the Transactions; from 272 papers in 1914 the number had fallen to 89 in 1918, but last year it rose to 182. The insufficient accommodation afforded by the Society's rooms in Burlington House was then referred to, and the hope expressed that means would be found to realise the aspirations of chemists as embodied in the proposals of the Federal Council for Pure and Applied Chemistry.

The toast of the Past-presidents, coupled with the names of Sir James Dewar, Sir Edward Thorpe, and Sir William Tilden, was given by Prof. H. B. Dixon, who outlined in brief but witty terms the outstanding achievements of these three guests of honour, and in their acknowledgments, Sir J. Dewar and Sir W. Tilden gave interesting reminiscences of their early associations with some of the chemical pioneers of the last century. Sir E. Thorpe was, unfortunately, absent owing to illness.

Prof. F. G. Donnan gave the toast of the Guests, which was replied to by Prof. Moureu, the Hon. Mr. Justice Sargant, and Prof. C. S. Sherrington.

THE OPTICAL SOCIETY.

At a meeting of the Optical Society held at the Imperial College on March 10, Mr. T. F. Connolly described and exhibited "A Handy Form of Measuring Microscope." The instrument comprises a microscope system of relatively low power; a double image prism traverses the object space, and is controlled by the rotation of a milled band operating a spiral slot. Exit pupil discs of telescopes or other optical instruments and Brinell impressions can be measured by a single contact setting of the edges of the duplicated discs. The range in the experimental instrument is from 1 to 6 mm., and the accuracy when used with a fixed focus for Brinell impressions is about ±0·02mm. The reading scale is very open and is divided to 0·1 mm. No vernier is used.

PERSONALIA.

Dr. F. H. Hatch has been appointed adviser to the Mines Department on questions relating to the metalliferous mining industry.

The Albert Medal of the Royal Society of Arts for 1920 has been presented to Prof. A. A. Michelson, professor of physics in the University of Chicago.

Dr. F. C. Thompson, Sorby Research Fellow in the University of Sheffield, has been appointed to the chair of metallurgy in the University of Manchester.

Prof. J. S. S. Brame, professor of chemistry in the Royal Naval College, Greenwich, has been elected president of the Institution of Petroleum Technologists for 1921-22.

Sir Edward Thorpe (Great Britain), Prof. Le Chatelier (France), Prof. Ciamician (Italy), and Dr. Ernest Solvay (Belgium) have been elected honorary foreign members of the Chemists' Club, New York.

The principalship of the Manchester Municipal College of Technology has been filled by the appointment of Prof. B. Mouat Jones, who has been professor of chemistry in the University of Aberystwith since 1919.

NEWS AND NOTES.

JAPAN.

The Wood-Distillation Industry.—The wood-distillation industry in Japan originated during the war, when the rubber planters in the East were entirely cut off from the German sources of supply of acetic acid, and Japan was called upon to meet their entire requirements. The consumption of calcium acetate in Japan has been large but variable during the last eight years; in 1913 it was 4049 long tons, in 1916, 577 t., and in 1919, 5398 t. Imports, formerly derived mainly from England and the United States, have since 1916 come from the latter country only. The demand for acetone is estimated at 600—700 tons per annum, and the country can now supply its own requirements. Much progress was made in the production of methyl alcohol until 1917; but since that year it has diminished considerably, partly owing to increased importation from America. The chief product exported is acetic acid, which goes to the Straits Settlements, British India, and the Dutch East Indies. Exports of this acid were 669 t. in 1915, 2470·6 t. in 1917, 2137·8 t. in 1919, and 890 t. during the first four months of 1920. The export trade diminished in 1920.—(*Chem. Ind., Dec.* 29, 1920.)

Menthol and Peppermint Oil in Japan.—Menthol is obtained as a residue in the refining of the oil distilled from a variety of peppermint grown in the Okayama and Hiroshima prefectures, in Yamagata, and in Hokkaido (the chief source). The crystals are exported mainly to America and the peppermint oil to England (formerly Germany). The total production, average prices, and exports during the period 1909—1920 were as follows:—

	Menthol.			Peppermint Oil.		
	Production.	Average price.	Total exports.	Production.	Average price	Exports from Yokohama.
	Long tons.	Sh. per lb.	Long tons.	Long tons.	Sh. per lb.	Long tons.
1909 ..	—	7.35	60.35	—	4.7	—
1910 ..	—	8.8	31.74	—	5.1	—
1911 ..	—	15.5	66.97	—	6.4	41.16
1912 ..	—	21.2	78.48	—	5.6	39.79
1913 ..	—	19.3	137.26	—	6.1	75.55
1914 ..	142.9	9.2	158.67	145.8	3.3	92.57
1915 ..	223.9	8.5	188.76	257.0	2.6	75.80
1916 ..	210.5	10.1	227.73	241.6	3.1	104.13
1917 ..	252.8	10.0	147.92	254.2	2.8	68.26
1918 ..	196.5	14.4	132.32	232.4	3.4	68.46
1919 ..	147.3*	31.6	132.59	89.3*	7.2	85.95
1920 ..	118.3*	43.0†	7.95†	118.3*	10.2†	11.36†

* Unofficial estimate. † Jan.-June, 1920.

—(*U.S. Com. Rep., Feb.* 3, 1921.)

UNITED STATES.

Magnesium in 1919.—A report of the United States Geological Survey, issued in 1920, states that 127,465 lb. of metallic magnesium, valued at $247,302, was made by three companies in 1919, a decrease of 55 per cent. in quantity and 60 per cent in value compared with 1918. The decrease was due to the cessation of the demand for war purposes and to lack of foreign orders. Most of the magnesium marketed was in stick form, but over one-tenth of the output was sold as powder. Average prices were $1.83 per lb. for stick magnesium and $2.85 for the powdered metal. Magnesium is prepared from anhydrous sodium-magnesium chloride, left after the extraction of salt from brines at Midland, Mich., and Pomeroy, Ohio; from magnesium chloride from the waters of the Great Salt Lake, Utah, and from sea water at San Francisco Bay; from Californian magnesite; and from precipitated magnesium carbonate. Metallic megnesium is mainly used as a deoxidising agent in metallurgy, but its use as a constituent of alloys is increasing and may eventually become the more important.

Abrasive Materials in 1918.—According to "Mineral Resources of the United States" (1918, Pt. II., pp. 1171–87), the total value of all abrasive materials, exclusive of felspar and quartz, consumed in the United States in 1918 was $10,991,964, of which about 26 per cent. represented natural abrasives. Imported abrasives were valued at $1,187,632. The production of grindstones and pulpstones, garnet, pumice, and grinding pebbles increased, and that of emery, corundum, diatomaceous earth and tripoli, and tube-mill lining decreased. American millstones are still mainly made of quartz sandstones and conglomerates, but some are made of granite; the production in 1918 was greater than it had been for about 30 years. Pulpstones are heavy grindstones used for grinding wood in the manufacture of pulp and paper; the increased production of 26 per cent. compared with that in 1917, and of 320 per cent. over that for 1915, was probably due to the difficulty and high cost of importing stones from Great Britain.

North Carolina is the sole producer of corundum; the output in 1918 was about 10,000 short tons, or 38 per cent. less than in 1917. Of diatomaceous earth, 2965 short tons was sold, but there was also a considerable production for special uses which the Geological Survey is not at liberty to report. Owing to the embargo placed upon all overseas imports of pumice, domestic supplies were developed and these proved quite satisfactory except for the finest work, viz., lithography and metal-polishing prior to plating; the production was 30,637 short tons. Similarly, the cutting off of supplies of "flint liners" for tube-mills (blocks cut from flint or other hard silicious rock) developed a domestic supply which proved quite satisfactory.

Three different kinds of artificial abrasives are manufactured in the United States:—(1) Metallic abrasives, including "diamond crushed steel" (crushed crucible steel), "angular grit" (crushed chilled iron), and "crushed cast iron" all made by the Pittsburg Crushed Steel Co.; (2) silicon carbides, including carborundum, crystolon, and carbolon; (3) aluminium oxides, including alundum, aloxite, etc. In 1917 the production of artificial abrasives amounted to 57,911 short tons, valued at $8,137,242; the production figures for 1918 are incomplete.

Peat in 1919.—The quantity of peat, excluding raw and including air-dried and mechanically-dried peat, produced in the United States in 1919 was 69,197 short tons, valued at $705,532, an average price of $10.20 per ton. This represents a decrease of 35 per cent. in quantity compared with the 1918 production. Most of the output was used for fertiliser purposes, either directly or as a nitrogenous ingredient of compound fertilisers; 6402 t. of carbonised peat was used as a constituent of cattle foods and a small amount as fuel.—(U.S. *Geol. Surv., Oct.* 14, 1920.)

SOUTH AFRICA.

Coal By-Products.—According to the General Manager of Railways, considerable attention is being given by the collieries to the recovery of coal by-products. There are large accumulations of waste and low-grade coal at the various collieries which, though not suitable for sale purposes, can be treated for by-products. The utilisation of this waste material has received greater attention during recent years, and it is said that the percentage of waste has been halved since 1910. Even to-day the waste coal is estimated at 1 million tons per annum. Much experimental work has been done recently on the testing of coal for the production of coke and tar and the distillation of oils and creosote. The companies are hopeful of the outcome of these by-product industries, and there is certainly a large field for development. The building up of a trade in coal by-products, which can be used in such a variety of ways, would be of inestimable value to the Union and would no doubt result in the creation of a number of new industries.

Mineral Production in 1920.—The Imperial Mineral Resources Bureau has received from the Department of Mines and Industries of South Africa the following statistics relating to the production of minerals and metals in 1920:—

	Weight.	Value.
	Fine oz.	£
Gold (output)	8,158,455	34 654 922
Silver (sales and shipments)	892 205	224,769
	Carats.	
Diamonds (output)	2,551,665	14,762,956
	Tons.	
Coal (total coal sold)	11,473,452	4,506,572
Copper ore and concentrates (sales and shipments)	10,874	445,007
Tin concentrates and metallic (sales and shipments)	2,451	446,284
Other base minerals (output)	—	153,694
Total value		55,194,204

* Value calculated at the standard rate of £4·24773 per fine ounce.

CANADA.

Projected New Sodium Carbonate Plant.—The Soda Mining and Products Company is to erect a new evaporating plant at Soda Lake in British Columbia. Soda Lake is situated 3700 feet above sea level, is 100 acres in extent, and its waters contain 6 per cent. of sodium carbonate.

Mineral Production in 1920.—The Chief of the Division of Mineral Resources and Statistics for Canada states that, viewed as a whole, the mineral industry was prosperous in 1920, although in Central Canada the fuel supply was inadequate and transport facilities insufficient; and in many camps labour was scarce and expensive. The production of copper, nickel, zinc, coal, etc., quickly recovered from the depression of 1919, but the present trade slump began too late in 1920 to have much effect on the mineral production of that year. Canadian mineral production has risen in value from $176,686,390 in 1919 to roughly $200,000,000, thereby closely approaching that for the maximum year, viz., $211,301,897 in 1918.

With an output of 27,455 long tons, nickel production showed an increase of 38 per cent. over that in 1919; the annual production of this metal for some years hence will be limited only by the demands of the market, as reserves are ample and the smelting capacity is in excess even of the highest war-time production (41,295 t. in 1918). There was an increase of 10 per cent. in the production of copper (36,830 t.), but the output of lead, including lead ingots and lead recovered from ores exported decreased to 19,565 t. British Columbia produced 13,524·5 long tons of refined zinc out of an estimated total of 18,750 tons (14,373 t. in 1919). The value of the gold output is estimated at $16,000,000 ($15,850,423 in 1918), over two-thirds of which was produced in Ontario. There was a general reduction in the output of silver; British Columbia produced 13,500,000 oz. compared with 16,020,000 oz. in 1919. Shipments of asbestos in 1919 included 136,765 t. of fibre and 22,471 t. of powder, a production which, it is estimated, was exceeded by 25 per cent. in 1920. The estimated output of coal, 16,000,000 short tons, was about 18 per cent. greater than in 1919, but the production of iron ore did not exceed 120,000 short tons, compared with 197,170 short tons in the previous year. There were larger outputs of pig iron and steel, the production in 1919 and 1920 being:—Pig iron, 917,781 and 1,080,000 short tons; steel ingots and steel castings, 1,030,342 and 1,220,000 short tons. (*Bd. of Trade J.*, *Feb.* 17, 1921.)

AUSTRALIA.

Mineral Production in 1920.—The following table, showing the mineral production of Australia in 1920, has been compiled by the Imperial Mineral Resources Bureau:—

	Production.	Exports.
	Long tons.	
Copper—		
Bar copper	24,069	28,612
In blister copper	2,000	2,000
In copper ore	115	115
Lead	4,077	50,069
In lead bullion	1,939	1,798
In concentrates	4,122	4,122
Zinc	9,665	5,689
Zinc concentrates	—	52,732
Tin	4,108	3,015
Pig iron	344,000	22,657
Arsenic	1,202	582
	oz.	oz.
Silver	701,177	341,001

The zinc concentrates contained approximately 11 oz. silver per ton, 47 per cent. zinc, and 7 per cent. lead.

Glassware Manufacture.—The annual imports of glassware into Australia are so great as to indicate that locally manufactured supplies fall far short of the demand. In view of the absence of any domestic glassware manufactory in Western Australia, the discovery at Wanneroo, near Perth, of a particularly high grade of glass-making sand is considered an excellent opportunity for establishing a useful secondary industry. Reports of the test of a bulk sample of the sand carried out in a well-known works in New South Wales fully confirm the opinion of the Government Mineralogist, Dr. G. S. Simpson, whose analysis gave:—Ignition loss, 0·08%; on ignited sand Fe_2O_3 0·4%, CaO nil, Al_2O_3 nil, TiO_2 0·007%, and SiO_2 99·81%. Colour of ignited sand, white.

The owners of the mineral claim have decided to form a company to work the deposit, and it is intended to secure the most expert advice that can be obtained. The raw material is so abundant and the quality so good that success seems assured. Western Australia is so situated that there is a big market in the Dutch East Indies and the Federated Malay States for goods of the description that it is proposed to manufacture, and there is every reason to believe that a good foreign market can be establised, apart altogether from the home demand.—(*Ind. Austral.*, *Dec.* 9, 1920.)

BRITISH INDIA.

Chemical Industries in Western India.—The annual report of the Director of Industries of the Bombay Presidency for 1919–20 states that Dr. A. N. Meldrum and Mr. D. M. Gangolli have written the first bulletin of the Department on the preparation of sulphuric casein. A large amount of casein is produced in the Bombay Presidency, but it is very crude, and the authors are working to produce a high-grade product. The hand-made paper industry at Ahmedabad has been studied by Dr. Meldrum and Mr. Bharucha, and efforts have been made to popularise the unglazed paper for filter work and as an absorbent for drying plants. The investigation of the Kharaghoda bitterns has been continued and a promising sample of Epsom salts has been obtained by Mr. A. J. Turner, who has also examined the economic production of refined salt from ordinary salt crystals. Favourable results were obtained, and a plant will, it is hoped, shortly begin working. The extraction of bromine from the bitterns at Kharaghoda and Aden has been investigated, but appears economically unpromising under present circumstances. The wood-distillation industry has been closely investigated and the conclusion was reached that it was inadvisable to erect a fully-equipped plant, as the demand for by-products had decreased. The demand for charcoal, however, is rapidly growing, and a plant producing charcoal of good quality, together with one or two by-products for which there is a market, would have a chance of success. Possible developments of hydro-electric power in the Presidency are being examined, as the price of Indian coal, like that of oil fuel, is increasing and supplies and labour are difficult to obtain. Power alcohol has also been considered, and a plant for producing a mixture of alcohol and ether is being completed in Hyderabad State, but development is hindered by the circumstance that any scheme to distil alcohol on a large scale in India would have to reckon with the competition of cheap alcohol imported from Java.—(*Indian Tr. J., Jan.* 21, 1921.)

GENERAL.

Sugar Beet in England.—It now appears certain that the beet-sugar factory of Home-Grown Sugar, Ltd., the company in which the Ministry of Agriculture holds half the share capital, will be ready by next autumn; much of the plant ordered from France has already arrived. Supplies of sugar beet for the present year have been contracted for, and although the factory will be able to deal with 600 tons of beet per day for 100 days, the tonnage for the first year is to be limited to 20,000, grown on 2365 acres, in order not to overload the factory, while the machinery is new, and to allow the staff to be adequately trained by the French specialists engaged. There are 425 farmers in Nottinghamshire and Lincolnshire who are cultivating an average of 5½ acres each, and it would have been possible to have doubled the acreage actually contracted for. For the reasons stated above, only 200 of the 400 acres originally contemplated are being grown on the Kilham Estate. The price payable per ton of beet delivered at the factory has been fixed at £4, equivalent to £3 17s. 6d. delivered on rail, and as experimental trials showed that the cost per acre of 12 tons (with an average sugar content of 20 per cent.) delivered on rail was £29 3s. 4d., there should be sufficient margin to induce the farmers not to limit expenditure on fertilisers, cultivation, and supervision, all factors that materially affect sugar content as well as yield.—(*Official.*)

Asbestos, 1913—1919 (H.M. Stationery Office, 34 pp., 1s.) is one of the most interesting pamphlets yet issued by the Imperial Mineral Resources Bureau. The name " asbestos " is applied to several fibrous silicate minerals differing from one another in chemical composition and physical properties. The principal asbestos mineral used in commerce is *chrysotile*, or serpentine asbestos, which is essentially a hydrated silicate of magnesium. It has great tensile strength and flexibility, is unattacked by acids, and is remarkably fire-resisting, although at 500° C. it becomes dehydrated and loses its tensile strength. It is a good insulator for both heat and electricity and is well adapted for spinning. *Crocidolite*, or blue asbestos, is a silicate of iron and sodium and is found in large quantities only in South Africa. It has great heat-insulating capacity, but its fire-resisting properties are poorer than those of chrysotile owing to its comparatively low fusibility. Asbestos cloth, rope, felt, etc., can be manufactured from crocidolite fibre, as also can sheets, tiles, cement, and other building material.

The commercial value of asbestos depends chiefly on tensile strength, flexibility, length and fineness of fibre, dehydrating temperature, and temperature of fusion, but other factors of importance are heat-insulating capacity, electrical insulating power, and colour. For spinning and weaving into fabrics, ropes, and engine packing, the qualities of first importance are tensile strength, fire resistance, and length of fibre. Although of greater monetary value, such articles form only a small proportion of the total output of asbestos manufactures. The larger proportion of the asbestos mined is used for sheets, tiles, slabs, millboard, joint-packing, etc. in the building, engineering, and electrical industries. Finely ground *anthophyllite* (silicate of magnesium and iron), low-grade *tremolite* (silicate of magnesium and calcium), and the residues from the chrysotile mills are used extensively in the manufacture of asbestos cements, fireproof bricks, tiles and other roofing material, paints, etc. Asbestos wool mixed with a solution of sodium silicate makes a fireproof cement of great strength.

The largest and most valuable deposits of asbestos occur within the British Empire. Canada has long been the chief producer of chrysotile asbestos (137,000 tons in 1919, or about 80 per cent. of the world's output). Rhodesia is second with about 8700 tons, but, arising out of the keen demand for Rhodesian fibre, a policy of rapid and extensive development is being pursued in that country. The Union of South Africa, which is the only producer of crocidolite, exported 3500 tons in 1919. Russia was formerly an important producer (17,200 in 1913), and other producing countries, in order of importance, are Australia, Cyprus, United States, India, and Italy. The price of Canadian No. 1 is stated to have risen from $300—$350 in 1913 to $2500—$3000 per ton in 1919. Cheaper grades range down to $25—$30 for " C short fibre." Most of the Rhodesian and South African asbestos is exported to Great Britain, but the Canadian output is exported largely to the United States, only relatively small quantities being sent to the United Kingdom.

The International Chemical Union.—The full report of the meeting which was held in Rome in June last has now been published from the offices of the secretariat at 46, Rue des Mathurins, Paris. (*Cf.* J., 1920, July 31, 251 R.)

Importation of Dyes and Dye-Intermediates.—The list of products covered by the Dyestuffs (Import Regulation) Act, which has been drawn up in consultation with the Dyestuffs Advisory Licensing Committee, is now available and may be obtained on application either to the Board of Trade, Industries and Manufactures Department, Great George Street, Westminster, London, S.W. 1, or to the Dyestuffs Advisory Licensing Committee, Board of Trade, Danlee Buildings, 63, Spring Gardens, Manchester.

Chemical Industry in Belgium.—The shortage of fuel and raw materials has prevented the Belgian chemical industry from recovering its pre-war position, but exports have been increasing. Supplies of sulphuric acid are very short, the production in the Gand district being at the rate of 40,000 tons per annum, compared with the pre-war output of 125,000 t., and owing to the strike the Vieille Montagne works are producing at only 40 per cent. of their capacity. The oil industry is in a difficult position on account of the high prices and shortage of raw materials, and the rubber industry is similarly situated. Full time, however, is being worked in the artificial silk industry, and export orders have been plentiful.—(*L'Ind. Chim., Dec.*, 1920.)

The Belgian Iron and Steel Industry.—In spite of the active reconstruction work carried on since the armistice, the Belgian iron and steel industry is still far from attaining its pre-war position, mainly because a large proportion of the labour has had to be diverted from production to repair work. Out of 51 blast furnaces, 21 are producing at the rate of 65 per cent. of the total 1913 production and 7 are ready for blowing in. There is sufficient coke for present needs, but gas coal for generators and Martin converters is in short supply. By the autumn of 1920 the iron and steel industry was producing 51 per cent. of its pre-war output of pig-iron, 69 per cent. of finished iron, 54 per cent. of steel ingots, and 62 per cent. of finished steel. Since May, 1920, the high prices have led to a reduced demand, and French, Belgian, and Luxemburg producers have had to agree to fix the price of pig iron at 500 fr. per ton. Further, the re-adjustment of labour costs to falling prices is a difficult problem, and, in spite of the progress made in reconstruction, the present market outlook provides no incentive for further expansion (*cf.* J., 1921, 15 R).—(*U.S. Com. Rep., Feb.* 7, 1921.)

The Belgian Glass Industry.—The Belgian glass industry, and in particular the plate-glass industry, profited by exceptionally favourable conditions during the early months of 1920, but now there is a general lack of new business and plate-glass manufacturers are curtailing production in order to maintain prices; the production of plate glass in the first eight months of 1920 was 98·5 per cent. of that in the same period of 1913. Window-glass manufacture is also seriously affected by the decline in demand, and prices have dropped by nearly 50 per cent. The problem of diminishing production costs by reducing labour charges has become so acute that arrangements are being made to introduce a process for drawing glass mechanically. The flint-glass industry has been less affected by the prevailing depression. There are at present 35 plants producing table-ware, and some of them, especially the Cristalleries Val St. Lambert, manufacture the highest and most artistic grades of cut-glass. Cut-glass and table-ware are exported to the United States to the value of about 500,000 fr. monthly. Much of the effectiveness of Belgian flint glass depends on the skill of the workmen, machinery being but little employed. The wages of glass workers and cutters vary from 25—30 fr. and 35—40 fr. a day, according to the district; increases have been at the rate of 320 and 400 per cent., compared with an increase of 370 per cent. in the cost of living since 1914. The exports of glass (in metric tons) during the first 8 months of 1920 were: Rough plate, 662; polished plate, 22,463; window glass, 120,466; common glass, 67; table-ware and cut glass, 15,225; bottles, demijohns, etc., 10,810. There has been an enormous increase in exports to the United States during the past year, viz., 3599 t. in the first ten months, compared with 162 t. in the same period of 1919.—(*U.S. Com. Rep., Jan.* 21, 1921.)

The Window-Glass Industry in Sweden.—Competition from Belgium has very seriously affected the Swedish window-glass industry; only three or four factories are now working. It is reported that Belgian firms are dumping window-glass on the Swedish market at prices below the cost of production, and that the industry has applied to the Government for higher tariffs and temporary import prohibition. During the period April to July, 1920, 1870 metric tons of window-glass was imported, and the home production was 2130 t.—(*U.S. Com. Rep., Feb.* 3, 1921.)

The German Fluorspar Industry.—The largest fluorspar deposits in Germany are situated in the Hartz district, Upper Palatinate, the Thuringian Forest, and the Black Forest; that found in the Upper Palatinate contains 95—98 per cent. of calcium fluoride and relatively little silica. The quantities supplied to the various consuming industries before the war were distributed as follows:—Iron and metal smelting, 79—84%; glass industry, 10—15%; chemical, enamel, and optical industries, 5% each. The use of fluorspar in the iron industry has increased since the armistice, as it effects an economy in fuel. Owing to the depreciated currency, German producers are able to sell fluorspar for exportation at lower prices than any of their foreign competitors.—(*U.S. Com. Rep., Feb.* 9, 1921.)

Carbon Dioxide as Fertiliser.—The possibility of manuring plants with furnace gases containing carbon dioxide by Dr. Riedel's method appears to be established, as his results have been confirmed by independent researches and trials by Bornemann and Reinau. Dr. Claassen, however, criticises the practicability of the method and its economy when used on a large scale. The plant for distributing the gases is inexpensive; all that is required is the main pipe and smaller pipes for conducting the gases to the different parts of the fields. Then by opening or closing the valves, the farmer can treat his plants with larger or smaller amounts of carbon dioxide according to the weather and the state of the plants. From the results it appears that lupins after treatment with gas gave, in the dry state, a yield 2·9 times greater than an untreated crop. A sugar-beet crop was increased by 85 per cent., with 1½ per cent. more sugar.—(*Chem.-Z., Feb.* 15, 1921.)

The Potash Industry in Germany.—A resolution to increase the inland prices of potash compounds by 50—55 per cent. was considered by the Potash Council (Reichskalirat) on February 1, but not carried as the voting for and against was equal. The representatives of agriculture and labour voted against the resolution. The case for increasing the prices included the following considerations. In spite of enormously increased costs of production, potash prices have not been raised since December, 1919. Whereas the price of potash has only risen five to sixfold since 1913, that of nitrogen has risen 9 times, phosphoric acid 19—20 times, and agricultural produce 10¼ times. Costs in the potash industry have increased since 1913 as follows:—Lignite 20 times; coal 13 times; wages 10 times; and costs of materials have risen far more than any of these items. The doubling of the railway freights in March, 1920, hit the industry particularly hard because coal from the Ruhr district being unavailable (under the Spa Agreement), the potash works have to use three times the amount of lignite, and this has to be transported distances up to 250 kilom. About 88 per cent. of the losses on inland sales in 1920 were made good by the export trade, but this was no longer possible in 1921. Employees have been dismissed from 21 of the works, further dismissals are taking place daily, and working hours have been curtailed at 46 works. The Labour Minister has just notified further increases in wages and fuel which, it is estimated, will entail additional charges on the industry of 42 million and 17 million marks, respectively. The Potash Syndicate is anticipating the closing down of many more works.—(*Z. angew. Chem., Feb.* 2, 18, 1921.)

The Balsam-Resin Industry in Germany.—A translation of an article on the German balsam-resin (Balsamharz) industry by Vice-Admiral D. F. Funke (*Handelszeitung, Feb.* 10, 1921) has been made available, together with supplementary information, by the Department of Overseas Trade.

Prior to the war the production of resin was increasing and imports were decreasing. Thus 113,481 tons, of which the United States supplied 78 and France 19 per cent., was imported in 1912, and 96,265 t. (U.S.A. 80, and France 16·5 per cent.) in 1913. The exports were 17,060 t. in 1912, and 25,803 t. in 1913, Austria-Hungary taking 31·4 and 30·5 per cent., and Russia 29·6 and 26·5 per cent., respectively. During the war the industry, controlled by the German Government and under the supervision of technical experts, was developed to a remarkable extent. Government control was abolished at the end of 1919, and the new companies that had been formed to treat the raw material were placed in a very precarious position. However, as a result of the intervention of the German Minister of Economics, an agreement was reached between the refiners and the consumers, under which a new company, the Deutsche Harz-Gesellschaft, was formed to take over the distribution of all the resin produced. All risks were borne by the consumers, who agreed to order what they required annually at a price to be based on the world's market prices at the time of the order. Resin manufacturers and merchants, however, have met with opposition from the Forest Authorities, who apparently have done all they could to obstruct the industry. Various excuses were made to diminish production, private forests were closed down, and finally a charge of 8 marks per kg. was made for the balsam-resin. Owing to the heavy fall in price in 1920, the demand ceased and representations were again made to the Minister of Economics which resulted in the price being reduced to 6 marks per kg. This did not satisfy the consumers, and efforts were then made to obtain statistics of the cost of production to the forest authorities. No figures were available for 1920, but official figures for 1919 showed that the Prussian forest authorities in 1913 made a profit by selling at 3 marks per kg. Further, the cost of production was so low that with a production of 1307 kg. per hectare (10·4 cwt. per acre) a profit of 2·57 marks per kg. was made. During the war the forests in the Oberost district actually produced 1500—2000 kg. per hectare, and these figures are now being put forward to prove that the forest authorities are over-charging.

The Beet-Sugar Industry in 1920.—In an article on the progress achieved in various branches of the beet-sugar industry during 1920 (Chem.-Z., Feb. 22, 1921), Prof. E. O. von Lippmann insists that this industry should be thoroughly re-organised. The American statement that single-germ seeds show increased resistance to animal and vegetable pests is not corroborated; opinions, in fact, differ as to the desirability of growing these single-germ seeds at all. Concentrating syrups on an extensive scale by means of low temperatures is, according to Pokorny, Linsbauer and others, impracticable both from the technical and economic standpoints. Stenzel's process for fermenting waste waters by means of yeast, with the object of manufacturing food-material, does not offer any prospect of success. Opinion is unanimous in Germany, France, Bohemia and other countries that the usual chemical control in beet-sugar factories is inadequate. Teyssier calls attention to the inaccuracy in calculating tho "rendement," or net sugar, of samples of raw sugar from ash determinations. British, American and most French sugar chemists have declared themselves in favour of adopting 20 grams as the new normal weight. Zeller, in his exhaustive treatise on tho relation between cane and beet sugar, comes to the conclusion that the world's sugar requirements cannot be satisfied by cane sugar alone since its supply is limited by technical, industrial and economic considerations. According to Bartens, the world shortage on September 1, 1920, amounted to 6 million tons, and in his opinion only the re-establishment of the beet-sugar industry can relieve the situation. The conditions in Czecho-Slovakia are the most promising. In Russia and Russian Poland all progress is checked for many years to come. In France also it will take years before the efforts now being made to re-organise the industry can materialise. In Germany, owing to all the reserve stocks having been exhausted by September 1, 1920, the price of refined sugar ultimately rose to 40 marks per kg. Moreover, according to a U.S. Consular Report of February 4, 1921, the total sugar production for the year 1919-20 was only 733,000 t., as compared with 1,346,000 t. in the previous year. To meet her domestic requirements in 1919-20, Germany had actually to import 57,000 t., or more than twice as much as during the preceding year, and a larger importation was only avoided by the existence of reserves from the previous season amounting to 216,000 t. The average yield of 7·5 t. per acre was the lowest for many years. Only 269 beet-sugar factories are now working in Germany.

Emil Fischer Bequest.—The late Prof. Emil Fischer left the sum of 750,000 mk. to the Prussian Academy of Sciences for the establishment of an "Emil Fischer Foundation"; the income from the fund is to be applied to the maintenance of young German chemists studying organic, inorganic, or physical chemistry.—(*Chem.-Z., Jan.* 22, 1921.)

Technical Education in Germany.—The number of students attending the Technical "Hochschulen" in Germany, including 1200 at the Köthen Polytechnic, is 21,000, compared with 18,900 in the winter semester of 1920–21, and 12,200 before the war. In electrotechnology the number of students has increased from 1300 to 3229; in mechanical engineering from 3100 to 6540; in chemistry, natural science, and pharmacy from 1544 to 3174; and in mining and metallurgy from 576 to 785. There are 3209 students at Charlottenburg, 2923 at Munich, 2591 at Hanover, 2264 at Dresden, 2206 at Darmstadt, 1631 at Stuttgart, 1491 at Karlsruhe, 1088 at Aachen, 872 at Brunswick, 837 at Breslau, and 779 at Dantzig.—(*Chem.-Z., Jan.* 22, 1921.)

New Carbide Factory in Hungary.—The first carbide factory to be established in Hungary has been erected at Felsögalla by the Ungarische Allgemeine Kohlenbergbau A.-G. and is now ready to start; it will have an initial output capacity of 80 waggon loads per annum, and will utilise charcoal as coke is in short supply. The chief consumers of carbide in Hungary include the State railways, mining enterprises, the oxygen industry, etc., and it is hoped that a large part of the country's needs in carbide will now be covered.—(*Handelsmuseum, Feb.* 10, 1921.)

Sicilian Phosphate Deposit.—A deposit of phosphate, extending over 10 kilometres, occurs on the shore at Donna Lucata, south of Scicli (Syracuse). The phosphates, present in the form of nodules of varying size, contain an average of 33 per cent. tricalcium phosphate (hand-picked specimens), and the reserve of utilisable mineral is stated to amount to 2 million metric tons.—(*G. Chim. Ind. ed. App., Feb.*, 1920.)

Graphite Production in Madagascar.—The French Colonial Ministry reports that trade conditions were so unfavourable during 1920 that no new graphite deposits were opened up, that operations at some of the old deposits were abandoned, and that the mineral has recently been sold at a loss. The export of graphite has declined from 27,838 metric tons in 1917, to 15,015 t. in 1918, and 4056 t. in 1919.—(*U.S. Com. Rep., Feb.* 5, 1921.)

Tung Oil in China.—Tung oil, or Chinese wood oil, is obtained from the nut of certain species of *Aleurites* which grow luxuriantly in hilly districts and seem to thrive in poor soil. The oil is usually extracted in the interior and shipped to Hankow, where it is stored. Its high price often leads to adulteration, soya bean, groundnut, sesame and cottonseed oils being used for this purpose. The exports from China from 1913 to 1919 were as follows:—1913, 37,598 tons; 1914, 26,164 t.; 1915, 18,473 t.; 1916, 30,665 t.; 1917, 23,890 t.; 1918, 29,098 t.; 1919, 36,515 t. There is room for considerable improvement in the methods of cultivation, harvesting and expressing, and the installation of modern machinery would, it is stated, increase the production by at least 10 per cent. Attempts to cultivate the tung tree in the United States are said to have been successful.—(*U.S. Com. Rep., Feb.* 9, 1921.)

CORRESPONDENCE.

A BRITISH CHEMICAL NEWS SERVICE.

Sir,—There is one notable omission from the literary activities proposed by the Federal Council for Pure and Applied Chemistry, recently made public. Sound suggestions are put forward for making scientific information available to chemists, but nothing is said as to one most important aspect of chemical publicity, namely, the means for keeping the lay public fully informed of the activities of chemists and their bearing on public welfare, for the success of both pure and applied chemistry is ultimately dependent npon an active and well-informed public opinion on all that relates thereto.

You, Sir, have already put forward the suggestion some time ago (*cf.* J., 1918, 27 R, 85 R) that the question of publicity should be taken up by technological and scientific societies on this side of the Atlantic, and I feel that the time is now more than overdne for a revision of our present policy of "laisser faire" in this matter. It is well known to chemists how strong a position the American Chemical Society now holds in forming public opinion in the United States, and there are more than sufficient indications in this country that we also need to make use of the medium of publicity for urging necessary reforms in order to ensure that an adequate weight of educated public opinion will be felt whenever chemical matters come up for consideration, whether the objective be peace or war.

The activity of the American Chemical Society in this direction forms so strong a contrast to our neglect that perhaps I may be permitted to quote from a recent issue of the *Journal* of the American Chemical Society:—

"The A.C.S. News Service continues to grow in usefulness. More and more it is finding a definite and accepted place in the newspaper offices of the country and, under the increased appropriation recently granted, it is proposed to extend this work as far as possible into the field of the weekly newspapers, thereby increasing more and more the public understanding of the significance of chemistry to the nation. Much time has been required to get the monthly clip sheet issued by the News Service thoroughly established The first attempts to include in this clip sheet textually-reproduced sections of the Journal did not yield very great success. This was then modified in form to cover popular treatment of articles appearing each month in the Journal, and the clippings being received show that this feature is now on a thorough basis and is being widely made use of by the press."

[The clip sheet referred to and the weekly bulletins are being sent to 900 of the leading American newspapers.]

To come to definite suggestions, the Chemical Industry Club might form a nucleus for the project, and weekly meetings might be arranged at the Club, at which a number of typed or printed slips could be distributed to the representatives of various papers and news agencies, with a word of explanation as to the possibilities of each article; the journalists could be trusted to make the best use of such free copy once they understood the nature of the work. By degrees the Club might be made a centre for all inquiries of a chemical nature, and with the formation of a definite *liaison* between the press and chemistry the news service would soon attain to very respectable dimensions. Now is the time to make the necessary preparations, and I would suggest that a meeting be called of all those interested in order to discuss ways and means for getting such a British Chemical News Service under way.—I am, Sir, etc., Fredk. A. Mason.

Manchester, March 14, 1921.

PARLIAMENTARY NEWS.

HOUSE OF COMMONS.

Trade in Dyes and Dyestuffs.

In a written answer to Major Barnes, Sir P. Lloyd-Greame stated that the imports into and the exports from the United Kingdom of coal-tar dyes and dyestuffs during 1920 were as follows:—

	Imports.	Exports.	
		U.K. manufactures.	Foreign and colonial manufactures.
	Tons.	Tonsi	Tons.
Coal-tar intermediates, including aniline oil and salt, and phenylglycine	2,487·5	3,668·4	201·75
Coal-tar dyes:—			
Alizarin	600·4	372·2	1·05
Indigo, synthetic	715·55	690·9	158
Other dyes	8,516·95	5,048·65	195·25

The imports were valued at £8,365,294, the exports of United Kingdom manufactures at £3,258,133, and exports of foreign and colonial manufactures at £305,555.—(Mar. 8.)

Coal Mines (Decontrol) Bill.

This Bill was read a third time on March 18. Its object is to put an end to financial control over the coal-mining industry on March 31, 1921, and to repeal as from April 1, 1921, Section 3 of the Mining Industry Act, 1920, which gives the State power to control prices, export, and wages. Further, it is proposed to divide the period of operation of the Coal Mines (Emergency) Act, 1920, into two periods, in the first of which the owners' profits are to be limited to the pre-war standards, and in the second the owners are to pay the surplus above or receive the deficit below nine-tenths of their prewar standards, instead of the whole.

Opium.

Mr. Montagu informed Mr. Gilbert that the agreement for the supply by the Government of India to the Government of Hongkong of 10 chests of opium per month at a fixed price had been renewed for a further period of five years as from January 1, 1921.—(Mar. 9.)

Dangerous Drugs.

Mr. Shortt, in reply to Mr. Woolcock, said that he had decided to appoint a small committee to consider and report what further modifications could safely be made in the draft Regulations, having regard to the principle that the use of the drugs under the Dangerous Drugs Act must be safeguarded in the public interest.—(Mar. 9.)

Coal Mining Industry.

Mr. Bridgeman gave the following statistics relating to coal mining in a written answer to Mr. G. Lambert:—

		1913.	1920
		s. d.	s. d.
Cost of raising an average ton of coal:—			
Wages		6 4	29 5½
Timber and stores		1 10	5 4½
Other costs			2 3½
Royalties		0 5½	0 7¾
Total cost		8 7½	34 1¼
Number of persons engaged		1,110,884	1,204,300
Amount of coal raised	tons	287,412,000	229,295,000
Amount of coal raised per person engaged	tons	259	190
Coal exported as cargoes	tons	73,400,118	24,931,853
Coal exported as bunkers	tons	21,031,550	13,840,360

In 1913 the owners' profits were at the rate of 1s. 6d. per ton, and the standard profits payable in 1920 are estimated to be at the rate of 2s. 6½d. per ton.—(Mar. 11.)

Basic Slag Supplies.

Sir R. Sanders informed Mr. A. T. Davies that there was no shortage of basic slag, as the decrease in production within the last two months had coincided with a still greater reduction of demand, and the stocks which had accumulated were twice as large as those held on the same date a year ago. Supplies of phosphatic fertilisers, including superphosphate, basic slag, and ground mineral phosphate for the coming season would probably equal, if not exceed, the supplies in any previous year.—(Mar. 17.)

Anglo-Persian Oil Co.

Mr. Chamberlain informed Col. Wedgwood that the Government holds two-thirds of the ordinary shares and 1000 out of a total of 8,500,000 preference shares in the Anglo-Persian Oil Co.; there was no intention of allowing the voting control over the company to lapse.—(Mar. 14.)

German Reparation (Recovery) Bill.

The German Reparation (Recovery) Bill, which was read a third time on March 18, provides that 50 per cent. of the money due as payment for German goods, or such percentage as the Treasury may prescribe, shall be paid, not to Germany, but to the Treasury through the Customs on account of German reparation. German goods are defined as (a) goods first consigned from Germany, and (b) goods consigned from elsewhere of which less than 25 per cent. of the value is attributable to production outside Germany. Transhipment goods are not affected. The Bill also contains provisions relating to valuation of goods, contracts, etc.

The Prime Minister, in reply to Mr. Pennefather, stated that the Bill would not in any way affect the promised legislation relating to dumping, collapsed exchanges, and key industries.—(Mar. 15.)

OFFICIAL TRADE INTELLIGENCE.

(*From the Board of Trade Journal for March* 10 *and* 17.)

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W. 1, from firms, agents, or individuals who desire to represent U.K. manufacturers or exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department and quoting the specific reference number:—

Locality of Firm or Agent.	Materials.	Reference Number.
Canada	Tiles	301
	Pure iron sheets for the manufacture of tanks and roofing	329
"	Whitening	335
South Africa	Earthenware, china, mirrors	304
Belgium	Metals, rubber	309
"	Lubricating oils	310
Bulgaria	Hides, textiles	342
Italy	Oils, fats	349
"	Crude leather	350
	Machinery for rubber manufacture	351
Latvia	Raw materials for soap making, soda, potash, tallow, coconut oil	313
Poland	Chemicals, raw materials for tanneries, leather	353
Spain	Chemicals, colours, paint, varnish	319
Argentina	Cheap glassware	358
Panama Republic	Vegetable oils paper	361

TARIFF, CUSTOMS, EXCISE.

Argentina.—The export duty on certain hides is suspended until February 2, 1922.

Australia.—Glycerin, crude and refined, for the manufacture of explosives may be imported duty free under the British Preferential Tariff.

Austria.—As from March 1 customs duties when paid in bank notes must be paid at 70 times the rates prescribed by the tariff.

Belgium.—Among the articles under the control of the Ministry of Industry, Labour and Supply that still require export licences are alcohol, matches, butter, lard, fats, malt, yeast, sugar, syrups, and molasses.

Authorisation of this Ministry is still required for the import of butter, malt, sugar, syrup, and molasses.

British India.—The general *ad valorem* duty of 7½ per cent. has been increased to 11 per cent. as from March 1. The customs duty on matches is fixed at 12 annas per gross of boxes, and that on imported liquers has been increased by 3 annas per degree of proof per gallon. The *ad valorem* duty on foreign sugar has been raised to 15 per cent.

Bulgaria.—The surcharge on customs duties when paid in paper currency is now 900 per cent.

Chile.—The increased customs duties take effect as from February 23. Condensed milk, cocoa, sugar, petrol, and oils are exempted from increase.

French Equatorial Africa.—A copy of the Decree establishing new customs regulations may be seen at the Department, 18, Queen Anne's Gate, London, S.W. 1.

Grenada.—The complete text of the revised schedules of Import and Export Duties may be seen at the Department.

Italy.—The stamp tax on perfumery, medicinal specialities, alcoholic beverages, and mineral waters has been doubled.

Kedah.—Export duties have been modified on, *inter alia*, rubber, rambong, damar, wood oil, tin ore, tin, wolfram, hides, bones, bricks, and tiles.

Kenya.—The import of condensed skimmed milk containing less than 9 per cent. of milk fat is prohibited as from February 5.

Netherlands.—The prohibition of the export of toluene has been removed.

Peru.—The export duty on vanadium ores and concentrates is fixed at £p.4.529 per metric ton, irrespective of their vanadic acid content.

A copy of the new customs tariff and customs regulations, effective as from October 15, 1920, may be seen at the Department.

Rumania.—Export duties have been reduced on rape seed, common soap, and toilet soap.

St. Christopher Nevis.—The revised schedules of customs duties came into operation on January 2. The complete text may be seen at the Department.

San Salvador.—The export duties on sugar, hides, and minerals have been revised.

Senegal.—Groundnuts may now be exported to the U.K. without restriction.

Sierra Leone.—The *ad valorem* import duties have been increased to 20 per cent.

The export duty on palm kernels prescribed by the Order in Council of March 29, 1920, has been revoked.

South Africa.—Asphalt, bitumen, pitch, and preparations thereof imported under item 76*a* of the customs tariff must contain less than 60 per cent. of mineral matter, and heavy oils imported under the same item must not lose more than 10 per cent. of their weight on being heated at 160° C. for 6 hours.

Trinidad.—The export of sugar is prohibited except under licence as from February 14.

Tunis.—The export tax on superphosphates is fixed at 1 franc per metric ton.

LEGAL INTELLIGENCE.

Rail Conveyance Classification of a Washing Powder.—*Joseph Crosfield and Sons, Ltd., v. London and North Western Railway Co.*

On March 4 the Railway and Canal Commissioners dismissed an application by Messrs. J. Crosfield and Sons, Ltd., that their preparation "Carbosil" should be classified in Class 2 for the purpose of railway conveyance. Until July 1, 1917, it had been so classed, but then the railway company decided to classify it as soap powder and charge for it in Class 1.

The case for the railway company was that the applicants had for years enjoyed the advantage of having "Carbosil" carried at Class 2 rates, and that their competitors had objected as all other washing powders were carried in Class 1. Applicants had refused to pay Class 1 rates because they maintained that "Carbosil" was an alkali. The amount of extra rate it was sought to obtain was about £1000 a year, and the business was growing.

In the course of the hearing, counsel for applicants admitted that in 1907-8 "Carbosil" had been advertised as a soap powder, but submitted that throughout the whole period the railway company had carried it in Class 2 with full knowledge of its composition; and it devolved upon the railway company to prove that the increased charge was a reasonable one.

Mr. Justice Lush said that the fact that "Carbosil" had been advertised as a washing powder showed that its classification in Class 1 was correct. On the point of the reasonableness of the increased charge, it was conceded that the railway company had the right to alter a classification after finding out that it had been incorrect; without deciding that question he thought that this was what had been done. He had much doubt if the charge under the Act had been increased at all, but assuming that the onus was on the railway company to prove that the increase was a reasonable one, he thought that it had abundantly proved its case. The applicants were liable for payment of any sums due.

Breach of Contract for the Sale of Calcium Carbide. *Acetylene Corporation of Great Britain, Ltd.* v. *Canada Carbide Co., Ltd.*

The action brought by the Acetylene Corporation of Great Britain against the Canada Carbide Co. of Montreal for alleged breach of contract in respect of the supply of calcium carbide during the war was terminated on March 9 in the King's Bench Division.

Plaintiff's case was that at the outbreak of war the defendant company had agreed to supply it with calcium carbide on condition that the Corporation had sole control of the sale of all the company's products in this country. The first contract was made for the delivery of 3600 tons beginning in December, 1915, all of which was delivered, but under the second contract only 200 tons was delivered out of a total of 7000 tons. The terms of both contracts stated c.i.f. United Kingdom, and provided that if freight cost more or less than 75s. per ton, the difference should be paid by or allowed to the defendant company. After the price of carbide had begun to rise in the middle of 1916, the company commenced secretly to sell direct to the Admiralty, f.o.b. Montreal, for shipment to this country, alleging that shipping space was not procurable for sending the goods to the Corporation. The latter claimed that shipping space was available, and that it had been declined because the company was supplying to the Admiralty. Hence the Corporation had to buy carbide at £25 per ton in order to fulfil its contracts to sell to the Admiralty at £18 per ton. In 1917 the Admiralty cancelled its contracts with the company, whereupon the latter offered to sell to the Corporation at $20 above the contract price, as it was obtaining $65—95 per ton from the Imperial Munitions Board in Canada. By 1919 the company had repudiated all liabilities under the contracts and had initiated a campaign for the sale of its goods in this country. The result was that the Corporation had to pay £25, £35, and £45 per ton for carbide it had contracted to supply, and that the company made large profits on goods it had contracted to sell to the Corporation at $45 a ton. The Corporation alleged a breach in 1917 and a continuing breach afterwards.

For the defence it was submitted that owing to manufacturing difficulties and lack of shipping space, the suspensory clause contained in the contracts came into operation from 1917 onwards; and that it was not established that the carbide sold to the Canadian War Department was sent to this country and thus came under the contract.

Mr. Justice Rowlatt gave judgment for the Corporation for damages to be ascertained.

TRADE NOTES.

BRITISH.

Canadian Imports.—Despite the adverse rate of exchange that prevailed during the year, the value of imports into Canada from the United States increased very greatly, the increase in the value of imported chemicals and allied products alone amounting to about $6,000,000 over that for the previous year. The fact that imports from the United Kingdom also increased greatly during 1920 show the splendid possibilities that exist in Canada for the development of a market for British goods. The following figures may be of interest in this connexion:—Imports from the United Kingdom into Canada for the twelve months ending November (December totals are not yet available) were valued at $229,925,844, as compared with $84,638,900 for the corresponding period in 1919–20; imports from the United States during the same periods were $927,564,711 and $725,968,553 respectively. Imports of chemicals and allied products, including such items as dyestuffs and explosives, from the United Kingdom for the period in 1920 were valued at $27,030,165, compared with $21,126,643 from all sources in the previous year. Exports to the United Kingdom for the period decreased, while exports to the United States increased, the figures being: to the United Kingdom, $352,083,388, against $514,012,960; to the United States, $545,283,365, against $443,416,125.

Ashanti in 1919.—The chief industries of Ashanti are the production of cocoa, kola, and gold. The cacao plantations suffered from drought and insect pests, factors which are limiting the extension of the crop; the production in 1919 amounted to 31,944 tons, but though this represented a decrease as compared with previous years, the quality showed a marked improvement. The kola crop was up to the average and 6171 tons was exported. Groundnuts have not been cultivated except on an experimental scale, but large areas are available for this purpose. The total yield of dry rubber was 6150 lb.; and 108 tons of skins was exported. Gold production was maintained during the year, the yield being 99,269·76 oz., valued at £421,698, as against 99,278·85 oz., worth £421,736, in 1918. Local industries, *e.g.*, weaving, basket-making, and pottery manufacture, are general throughout the country, but are not exported.—(*Col. Rep.—Ann.*, *No.* 1058, *Jan.*, 1921.)

FOREIGN.

Deliveries of German Potash to America.—The *Deutsche Bergwerks-Zeitung* of February 19 publishes a report that the Potash Syndicate intends meeting America half way in regard to the sale of potash. The unsold stocks of chloride of potassium in America amount to 20,000 tons, and a further 29,000 tons, valued at 47,421,400 mk., is lying at German harbours ready for despatch. In order to put an end to the dispute concerning the " Baisse clause," the German Potash Syndicate intends to deliver 40 per cent. of the amount of potash already delivered at a rate far below that agreed upon for the old contracts. Owing to the depreciation of the American exchange, large sums of money have been lost on the 20,000 tons lying in America, the value of which is estimated at $1,043,357, and the German Potash Syndicate, by these supplementary deliveries, wishes to make good to a certain extent these American losses in order to create a new basis for trade.—(*Official*.)

The Chinese Soap Trade.—The use of washing soap in China is practically limited to the areas at or near treaty ports and large trading centres. In the interior a kind of vegetable soap, known as soap bean, is used in laundry work. Imported soaps were formerly widely sold in the treaty ports and outlying districts, but have now to face considerable competition from native products. Some 60,000 cases of soap are produced yearly in Hankow by four native soap works, which are equipped with little or no machinery. Foreign firms that sell soap in China require cash in advance, whereas the native manufacturer sells on consignment and allows long credits and other facilities, with the result that several foreign soaps no longer command a market. The imports of washing soap in 1913, 1915, 1917, and 1919 amounted to 1029, 916, 1099, and 468 tons, respectively. There are almost unlimited possibilities for the development of this industry, and the abundance and cheap supplies of both raw materials and labour would suggest the establishment of foreign-owned factories in China. Apparently the possibilities of developing the toilet-soap trade are even greater, and the establishment of a factory in China for this purpose would doubtless meet with success. The value of the imports of toilet soap in 1919 was £48,148.—(*U.S. Com. Rep., Dec.* 20, 1920.)

Foreign Company News.—*Czecho-Slovakia.*—A group of German textile manufacturers has formed a new company in Prague to manufacture artificial silk.—(*U.S. Com. Rep., Dec.* 13, 1920.)

France.—The capital of the Société Chimiques des Usines du Rhône is to be increased to 21 million francs.

The Compagnie Nationale de l'Azote (capital 12,500,000 fr.) has been formed to take over the contract made between the French Ministry of Reconstruction and the Badische Anilin- und Sodafabrik for the exploitation of the company's process of manufacturing synthetic ammonia and derivatives thereof (*cf.* J., 1920, 305 R). The directorate of the new company includes representatives of various banks, the Cie. des Mines de Béthune, the Cie. Nationale des Matières Colorantes et de Produits Chimiques, the Etablissements Kuhlmann, the Société des Products Azotés, and Solvay et Cie. (Brussels).—(*Rev. Prod. Chim., Jan.* 31, *Feb.* 15, 1921.)

The Upper Alsatian Potash Mines (Société des Mines de Potasse du Haut-Rhin, Société par actions à Mulhouse) has just formed a subsidiary company with a capital of 1,500,000 fr. to exploit the potash mines in Alsace, which will endeavour to acquire all mining concessions, mines or works, whether belonging to companies, private persons of the State. The original capital is 1,500,000 francs.—(*Deutsch. Bergwerks-Z., Feb.* 19, 1921.)

United States.—It is announced that the Society of Chemical Industry in Basle has decided to enlarge the Ciba Co., Inc., and to take over the whole organisation and branches of the Aniline Dyes and Chemicals, Inc. The Ciba Co. will distribute both the Swiss and American dyes. The factories owned by the Society of Chemical Industry in Basle are situated at Basle, Petite Huningue and Monthey in Switzerland, at St. Fons, in France, Pabianice in Poland, Moscow in Russia, Manchester in England, and Cincinnati in the United States.—(*Oil, Paint and Drug Rep., Feb.* 7, 1921.)

REVIEWS.

INTRODUCTION TO QUALITATIVE CHEMICAL ANALYSIS. *By* TH. W. FRESENIUS. *Seventeenth edition of the original work by* C. R. FRESENIUS. *Translated by* C. A. MITCHELL. *Pp.* 954. (*London: J. and A. Churchill.* 1921.) *Price* 36*s. net.*

The appearance of an English translation of the seventeenth German edition of Fresenius's " Qualitative Analysis " will be welcomed by all English-speaking chemists. The present volume is twice the size of its predecessor, published in 1897, and there is much alteration in detail, although the same general plan is maintained. Part I deals with chemical principles and methods and the behaviour of substances towards reagents. Here are brief accounts of physico-chemical theory as it affects analysis and of the operations of the laboratory. Then follow the reactions of kations and anions, including those of the rare elements and various organic acids. Part II is concerned with the systematic course of analysis and embraces practical methods of the general course and for special cases, together with explanatory notes. Lastly, the appendix includes the reactions of alkaloids and glucosides, remarks on the choice of exercises, the method of tabulating results, and solubility tables. There is an adequate index.

The guiding principle of the book is denoted by these words from the preface:—" Chemical analysis demands a knowledge of the fundamental laws of general chemistry, of analytical operations, and of the behaviour of individual substances towards reagents. Given these essentials, it is possible, with the aid of a systematic procedure, to undertake the investigation of unknown substances." The whole volume is an elaboration on a most extensive scale of this fundamental thesis.

Perhaps the analyst will find the book too large to be a bench companion, but in this case he will desire to have it near for reference, because it is a chemical classic which has been brought thoroughly up to date. Especially noteworthy is the information regarding the chemical reactions of the rare metals; probably in no other place can this information be obtained in so convenient and extensive a form. An improvement on former editions is the inclusion of tables of separation for the successive groups of metals.

A few comments on details may be made. The use of iron is quite the simplest method of separating antimony from tin, and the beginner can hardly fail to succeed with it; but most of the acid used to dissolve the two sulphides should be removed or neutralised to facilitate the reduction of the antimonious solution by the iron. The method of separating calcium from strontium by ferrocyanide is interesting and little known. The statement (p. 630) that permanganate may be formed when a manganese compound is fused with potassium chlorate and sodium carbonate cannot pass; manganate, not permanganate, is the stable salt under these conditions; indeed, potassium permanganate is converted into manganate when fused with alkali carbonate even in presence of chlorate.

On pp. 634–5 it is said that the ammonium sulphide precipitate may possibly contain, not only hydroxides and sulphides of various metals, but also phosphates, borates, oxalates, silicates, and fluorides; and there follows a very elaborate scheme for the separation of all these components. It is unnecessary for this precipitate to contain any of the latter salts, and the elaboration may consequently be avoided.

By various means interfering anions can be eliminated from solution before testing for kations, just as interfering kations are eliminated, by means of sodium carbonate, before testing for anions.

On p. 113 the compounds $HAuCl_4$ and H_2PtCl_6 are wrongly called aurohydrochloric acid and platinohydrochloric acid respectively; and on p. 199 the salts of tervalent titanium are unfortunately called titanic salts.

The translator and publishers are to be congratulated on their work. The style and arrangement leave nothing to be desired. It is necessary, however, to call attention to one blemish, viz., that some of the formulæ are misprinted. In the table above referred to (pp. 634–5) the following erroneous formulæ occur: $H_3B_2O_3$, $K_2Co(NO_2)_6$, CaF_3, $Ba_3(PO_4)_3$, $Mg(NH)_4PO_4$; and there are a few other similar errors elsewhere. Small defects like the above, however, scarcely detract from the value of so great a work.

R. M. Caven.

Chemistry of Pulp and Paper Making. *By* E. Sutermeister. *Pp.* 479, *with* 55 *text-figures and* 31 *plates.* (*New York: John Wiley and Sons; London: Chapman and Hall.* 1920.) *Price* 33*s. net.*

This volume has been prepared "with the idea of helping the young technical man, whether chemist or chemical engineer," in the pulp and paper industry. The author is a well-known mill chemist of some twenty years' experience, and the book is based on his "personal notes and experiences" collected during that period.

As a scientific introduction to the chemistry of the industry it falls below the level of Griffin and Little's "Chemistry of Paper Making" (now old and out of print), and as a manual of technology cannot be classed with Cross and Bevan's "Text Book of Paper Making" (fifth edition, 1920). We make this comparison because in our opinion these are the two text-books which have had the most influence on the industry in America and England, and also because the general arrangement and aim of the book now before us follow on the lines laid down in these "classics" of paper-making.

On the whole, this book may be fairly described as a mill chemist's note-book, based on a limited but practical experience of the industry, arranged on a well-conceived plan, and enlarged by copious references to current literature on the subject. Its chief points of interest to the paper-mill chemist in this country are:—(1) An excellent and concise account of American woods and wood-pulp processes (comprising about one-third of the volume); (2) about two dozen well-reproduced half-tone plates of paper-making fibres (from photomicrographs); (3) the numerous references (over 300) to technical literature given in the foot-notes; and (4) indications of American practice in certain routine tests from which some very useful hints may be gathered by the practical man who has sufficient experience to read between the lines.

The author writes in a simple and clear style, but we do not consider his habit of stating inconsistent conclusions suitable to the young student. For example, his claim (p. 250) that bleached sulphite possesses greater strength than the unbleached fibre, compared with his statement (p. 252) that the more bleach used the greater will be the attack on the cellulose, is confusing. The first parapraph on rosin (p. 264) contains an obvious mis-statement concerning reasons for selection of the grades used in sizing.

From the consulting chemist's point of view this volume is a commentary on a certain aspect of the technical chemist's work. It is neither pure nor practical chemistry, and applied chemistry is only incidental and explanatory. The successful paper-mill "chemist" is expected to have a knowledge of practical botany, mineralogy, engineering, and physics in addition to chemistry, and his chemical analyses are done largely to interpret and confirm the results of physical tests.

The author presents much valuable information in a readable and handsome form, but we de not consider that he succeeds in attaining fully the aims outlined in the title and preface.

James Strachan.

The Practice of Lubrication. *By* T. C. Thomsen. *Pp.* x.+607. (*New York and London: McGraw-Hill Book Co., Inc.* 1920.) *Price* 36*s. net.*

Mr. Thomsen in his preface rightly states that lubrication has for many years received only scant attention. Surely this was inevitable so long as lubricating oil companies regarded the scientist as an unnecessary adjunct to their advancement. Now that the engineer is demanding more exact information about the oil he uses, there is a growing feeling that more chemists are needed to investigate the many problems presented. Lately several well-known workers in the industry have written books to meet the growing demand for knowledge, and Mr. Thomsen is one of them. Mr. Thomsen's opportunities for acquiring information on lubricating systems have probably been unique; therefore, a record of his experiences is very welcome.

The book is designed chiefly for the engineer, but since the chemist is called upon to understand lubricating systems, it must also appeal to the chemist. The engineering sections are really well done, and the illustrations are very clear. The chemical portion is scanty, but doubtless this was deliberate, as the main object of the book was to deal with the actual use and application of lubricants in practice. There is just a hint, however, in the preface that the chemist is merely an assistant to the engineer!

From time to time various theories have been advanced to explain the production of acids and of solid deposits from mineral oil, and perhaps the belief that the unsaturated hydrocarbons are the progenitors of these decomposition products has been the most popular. The theory appears to have been based upon speculative arguments and not upon experimental results. Thomsen's faith in this theory appears to be evident from the fact that he states that hydrocarbons of the formulæ C_nH_{2n-2} and C_nH_{2n-4} are more or less unsaturated; in fact the former group is characterised by the acetylene linkage. Further, he states that the colour of an oil is due to the presence of unsaturated hydrocarbons, and that colour is a criterion of the stability of an oil. It does not require much experimental work to shed considerable doubt upon the accuracy of these statements.

One would prefer to have seen the word "adsorbed" instead of "absorbed" on page 9; and on page 14 it would have been better to state that nitronaphthalene masks the fluorescence instead of removes it. The apparatus described on p. 591 was surely designed at the National Physical Laboratory, and that which Thomsen suggested and described in the J. Inst. Elect Eng., **50** (1915), 239, 155, is quite different from this. In this connexion it might be suggested that a few references to other workers would enhance the value of the book.

The large number of oil specifications are of great value, although in some cases differences of opinion may be expected. The inclusion of the subject of oil consumption is also very valuable, but no doubt the reader will be astonished at the wide limits given; but these are inevitable owing to the different conditions prevailing in engines of even the same class.

Whenever a chemist is called up to report upon a lubricant, he will benefit by referring to "The Practice of Lubrication" before appending his signature.

E. A. Evans.

Bibliotheca Chemico-Mathematica. *Catalogue of Works in Many Tongues on Exact and Applied Science, with a Subject-Index. Compiled and Annotated by* H. Z. *and* H. C. S. *Two volumes. Pp.* xii+964. (*London: Henry Sotheran and Co.* 1921.) *Price* 63*s. net.*

These volumes are of so unusual a nature that they are worthy of detailed notice. The main contents of the work were first issued as a series of annotated sale catalogues, and in their original form they were of considerable value to bibliographers and librarians for reference purposes. Their publication in two well-bound volumes, together with an adequate subject index, should increase the scope of their usefulness. The addition of portraits and facsimiles of high artistic and technical merit adds to their attractive character. The portrait of Dr. Thomas Young is a particularly fine example of photo-reproduction. The biographical and descriptive references are both interesting and instructive, though it is a pity that extraneous comments were introduced in the last few pages published during the war. We may agree with the sentiments, but the remarks hardly appear to have any direct connexion with the items to which they are attached.

In view of the large field covered by these volumes, it is not remarkable that a few inaccuracies occur. On page 208 there is a statement that only one volume was published by the Royal College of Chemistry, that of 1845-7, whereas a second was published in 1853, covering the years 1848–51. That Storer's Dictionary, Cambridge (Mass.), is "the only dictionary of chemical solubilities ever attempted" is also erroneous, as one was compiled by Comey in 1896, and another by Seidell in 1907 (2nd edition 1920). The first edition of Accum's "Chemical Amusement" is dated 1819, but as the copy contains a list of chemical apparatus not included in the 1819 edition, this is obviously a misprint for 1817.

The mention of a "neatly written" MS. as possibly the one used by Robison when compiling his edition of Black's Lectures suggests the speculation as to how many of these manuscript copies are still in existence. From time to time the writer has come across these MSS., the owners of which fondly supposed that their copy was either the original, or that of Robison. Reference to Robison's preface shows that the former consisted of single octavo leaves, full of erasures and difficult of transcription, whilst the latter contained whole pages and many alterations in Black's autograph, so that either should be easily identified.

Messrs. Sotheran are to be congratulated on their enterprise in producing a catalogue of books which is also a record of permanent utility, and by publishing it in its present form they have rendered a distinct service to those interested in the history and bibliography of science.

F. W. Clifford.

OBITUARY.

S. H. BLICHFELDT.

By the death of Sören Höy Blichfeldt at the early age of 44, the margarine industry loses one of its ablest technologists. Blichfeldt, who was Danish by birth, graduated from the Royal Pharmaceutical College, Copenhagen, and came to England in 1906 to take up the position of technologist to the Maypole Works at Southall. He had previously been engaged for a few years on bacteriological and fermentation research work, and having a remarkable gift of applying science in the works he was able very soon to improve and develop methods of manufacture. This service was rendered not merely in the narrower sphere of his company, but in the wider interests of the margarine industry generally.

S. H. Blichfeldt's name will be familiar to members as a contributor to the Society's literature, and one could not meet him without being impressed by the great fertility of his mind and his wonderful power of conceiving methods and processes. Many men with faculties so fully developed are so absorbed in their theories that all else in life is excluded; but Blichfeldt was a keen sportsman, a skilled musician and, to all who knew him, a charming companion—a wonderful combination which makes his loss the more keenly felt by his colleagues and friends.

E. Skjold.

PUBLICATIONS RECEIVED.

Applied Colloid Chemistry: General Theory. *By* W. D. Bancroft. *International Chemical Series, edited by* H. P. Talbot. *Pp.* 345. (*New York and London: McGraw-Hill Book Co., Inc.* 1921.) *Price* 18*s.*

Electrolytic Deposition and Hydrometallurgy of Zinc. *By* O. C. Ralston. *Pp.* 201. (*New York and London: McGraw-Hill Book Co., Inc.* 1921.) *Price* 18*s.*

Lehrbuch der Farbenchemie. *By* Dr. H. T. Bucherer. *Second edition, revised. Pp.* 636. (*Leipzig: Otto Spamer.* 1921.) *Prices: unbound* 47*s.* 1*d., bound* 51*s.*

A Text-Book of Dye Chemistry. *By* G. von Georgievics *and* E. Grandmougin. *Second English edition, translated from the fourth German edition (with additions) and revised by* F. A. Mason. *Pp.* 560. (*London: Scott, Greenwood and Son.* 1920.) *Price* 30s.

The Chemistry of Synthetic Drugs. *By* P. May. *Third edition, revised. Pp.* 248. (*London: Longmans, Green and Co.* 1921.) *Price* 12*s.* 6*d.*

Red-Lead and How to Use it in Paint. *By* A. H. Sabin. *Third edition, rewritten and enlarged Pp.* 139. (*New York: John Wiley and Sons, Inc.; London: Chapman and Hall.* 1920.) *Price* 11*s.* 6*d.*

Lead Ores. *By* T. C. F. Hall. *Imperial Institute Monographs on Mineral Resources, with special reference to the British Empire. Pp.* 127. (*London: John Murray.* 1921.) *Price* 6*s.*

Transactions of the Incorporated Sanitary Association of Scotland, 1920. (*Published by the Association,* 88, *Bath Street, Glasgow.*)

Journal of Indian Industries and Labour. *Vol. I., Part I. February,* 1921. (*Calcutta: Superintendent Government Printing.* 1921.) *Price Rs.* 1-8 *per part, Rs.* 4-8 *per volume of* 4 *parts.*

Corrigendum.—In the last issue, p. 97 R, col. ii., in the sixth line from top, read "geranial" instead of "geraniol."

SOCIETY OF CHEMICAL INDUSTRY.

THE ANNUAL MEETING, 1921.

MESSAGE FROM THE PRESIDENT.

As has already been announced, the next annual meeting of the Society of Chemical Industry will be held in Canada, in response to a very hearty invitation extended by the Montreal Section; the formal meeting extends from August 29 to August 31, but our Canadian friends have expressed the wish that the party from Europe will arrive a few days earlier so that they may be shown some parts of Canada not included in the extensive official programme now being compiled. It will thus be convenient if as many of the visitors as possible will travel with me by the "Melita," which leaves Liverpool on Friday, August 12, and arrives at Montreal on or after August 22.

At the close of the business meeting on August 31, the members will leave Montreal by a special train for a four days' triangular tour of Eastern Canada, during which visits will be paid to the paper and pulp works at Grand Mere, the largest in Canada, to the carbide and synthetic-acetic-acid factories at Shawinigan, and possibly to the aluminium and magnesium electrolytic plants. September 2 will be spent at Ottawa and the next two days at Toronto. A boat trip across the Lake has been arranged in connexion with a visit to Niagara and to the chemical works and fruit farms on the Canadian side of the river. September 6 will be spent in an inspection of the electrochemical works on the American side of the Niagara Falls, and the party will then proceed by train to New York.

From September 7 to September 10 the party will co-operate in a joint meeting of the Society of Chemical Industry and its American Section and the American Chemical Society; it will visit the great Chemical Exposition which opens at New York on September 12, and which will certainly be one of the most important exhibitions of the chemical industry which has ever been held.

During the critical period through which all branches of the chemical industry are at present passing, when old markets are falling away and must be replaced by new ones, it is more than ever essential that British industrial chemists should seize every opportunity of gaining acquaintance with the conditions which prevail in the British Dominions and abroad; only by personal visits and by the establishment of new friendships and fresh business relationships can our members hope to be able to raise our chemical industries to the position indicated for them by the history and the geographical environment of these islands. Our Canadian and American friends have intimated their desire to furnish uncommonly extensive facilities for the inspection of works concerned with every branch of chemical industry, and it is certain that similar facilities cannot be granted to private individuals travelling alone apart from an official party such as is now being formed. The Council therefore desires to urge the members of our Society to make every effort to accept the generous invitation extended to us by our transatlantic friends; we are convinced that the maximum benefit to our Society and to the chemical industries of Great Britain, of Canada, and of the United States can only be derived by the attendance of a large British party at the coming annual meeting.

William J. Pope.

Supplementary to the provisional programme which appeared in the *Journal* for December 15 last, we are now able to give the following details concerning the arrangements which have been made for the period August 26—31, to be spent at Montreal:—

Friday and Saturday, August 26—27:—Reception Committee meets Visitors.

Sunday, August 28:—Golf. Motor-trip around City and Island.

Monday, August 29:—

Morning: 10 a.m., Council Meeting at McGill University; 11 a.m., Annual Meeting. (a) Address of Welcome; (b) Reply; (c) General Business of the Society.

Afternoon: 1 p.m., Civic Reception and Lunch. 3 p.m., Special Visit to McDonald Agricultural College. Supper and Garden Party.

Tuesday, August 30:—

Morning: 10.30 a.m., (a) Address by a prominent Canadian chemist; (b) Pulp and Paper Symposium (3 papers).

Afternoon: 1 p.m., Luncheon at Windsor Hotel, given by Montreal Section. 3 p.m., Visits to various industrial plants.

Evening: 7.30 p.m., Banquet at Windsor Hotel.

Wednesday, August 31:—

Morning: 10 a.m., Special Addresses and Technical Papers.

Afternoon: 1 p.m., Luncheon at Windsor Hotel given by Montreal Section. 3 p.m., Special Convocation at McGill University. 4 p.m., Trip down Lachine Rapids.

Evening: 11.55 p.m., Leave by night train for Shawinigan.

NEWS FROM THE SECTIONS.

SHAWINIGAN FALLS.

At a meeting held on March 12, Dr. F. W. Skirrow presiding, Dr. John S. Bates, formerly director of the Forest Products Laboratories of Canada, gave an address on "Pulp and Paper."

The subject of forestry should be taken more seriously by the public, because the time has come when plans must be carried out on a large scale to protect and reproduce our crop of trees for all the wood-using industries. Canada's reserves of timber rank next to those of Russia and the United States, but even this strong position must be protected to ensure permanent supplies for the Dominion and the rest of the world. Forest fires have burned down ten times as many trees as the loggers have felled. In the east there are still large supplies of pulpwood trees, but British Columbia has most of the big timber. Fortunately, over 90 per cent. of the timber land remains under Government ownership, and the problem is fairly simple if the public will only demand and assist State action in conserving the timber resources. As over two-thirds of the land area in the settled portion of Canada is unfit for agriculture, there is ample scope for development.

The pulp and paper industry now heads the list of manufactures in Canada, and also leads all others in export trade. This may be traced directly to the natural resources of pulpwood and water power. To a large extent paper is made from raw materials not suitable for other purposes. Cotton goes into textiles, and the waste clippings, rags and linters supply the higher-grade paper mills. The best trees are cut into lumber, but the smaller sizes and inferior species are good enough for most grades of paper products. The problem in making paper pulp is to dissolve out the lignin and other carbohydrates in the wood, and to separate the flexible fibres of white cellulose. Wood is the outstanding source of fibre for papermaking, because the length of the natural fibre is just right, the yields of pulp are high, wood is cheap, abundant and compact, and, finally, it floats down our rivers and is easily handled. The conifers such as spruce, balsam fir, hemlock, and jack pine are low in resin content, and have fibres about ⅛ in. long and 0·01 in. wide. The hardwoods such as poplar, basswood, and birch are more resistant to pulping, and have fibres about one-third the size of the softwoods, so that their use is more limited.

The speaker then outlined the groundwood, sulphite, sulphate, and soda processes by which wood is converted into mechanical and chemical pulp. The characteristic properties of the different kinds of pulp fibres were illustrated by samples of paper pie-plates, newsprint, wrapping paper, board products, magazine paper, writing paper, and bank-note paper. The methods of beating, bleaching, sizing, and loading to give the desired formation and finish were described. In conclusion, the scientific trend of the industry in the direction of improvements in processes and machinery, saving of by-products, and quality of products was pointed out.

BRISTOL AND SOUTH WALES.

A meeting was held at the University College, Cardiff, on March 4, with Prof. C. M. Thompson in the chair. Mr. Donald Brown read a paper on "Paper-making," in which he described the various processes employed from the felling of the timber in Sweden to the finished roll, and explained the different types of machinery used. The paper had special reference to the Ely Paper Mills, Cardiff, which were subsequently visited by the Section on March 10, by the courtesy of Messrs. T. Owen and Co., Ltd.

At Bristol on March 17, Mr. E. Walls (chairman) gave an address on "Chemical Industry in Bristol."

Except for the purely engineering, boot manufacturing and clothing trades, there was no productive industry in Bristol which was not interested in technological chemistry. Chemical engineering was strongly represented in gas manufacture, an industry which was introduced into their city in 1811 by a Mr. Briellat, who was accused of having "unholy dealings with an infernal power." The Bristol Gas Co. started operations in 1816 with a capital of £5000 and experienced many vicissitudes (among which was the refusal to lay pipes on account of the danger), but it outlived the competition of a works which started producing oil gas in 1824. The local tanning industry derived much benefit from the importation of hides from Ireland, and the oil, paint, and varnish industry probably owed its origin to local supplies of ochre and importation of logwood from the Indies. Floorcloth, the forerunner of linoleum, was introduced in Bristol by John Hare in 1782. The fame of Bristol brewing went back many centuries. The distillation of petroleum for toluene was carried out on an enormous scale during the war; in fact, no less than 80 per cent. of the total output of toluene in 1915 was produced at Portishead, the plant for which was shipped *en bloc* from Rotterdam. Alcohol was distilled locally for munitions purposes during the war, as were also aromatic hydrocarbons, phenol, and glycerin. At Netham there was the large plant of the United Alkali Co. producing soda by the Leblanc process, also caustic soda, chlorine, bleaching powder, sulphuric acid and other products. Glass-making was an old-established Bristol industry largely engaged in making bottles for imported wine; in 1797 there were 14 glass works in operation. The Avonmouth works, erected during the war, might have given Bristol a preponderating position in chemical industry, the total capacity of the sulphuric acid plant being sufficient to supply the whole requirements of Europe, but, unfortunately, it had been closed down. In fine chemicals they had no standing, but Bristol had always been a pharmaceutical centre. The refining of copper and manufacture of brass from cupriferous residues from Cornish tin-ore was started about 1705, calamine from the Mendip mines being also used. The brass-wire industry was developed on a large scale, and in 1712 it was stated that the brass and copper works consumed 2400 tons of coal per week. There was also an important lead industry in the 17th and 18th centuries. The oldest chemical industry in Bristol was soap manufacture, which dated back to the 13th or 14th century; this industry suffered severely in 1631 when the King granted the monopoly of soap-making to certain Londoners. In conclusion, Mr. Walls referred to the help which the local chemical industries and the Section had received from the Chemical Department of the University, and stated that with such assistance there should be a bright future for chemical industry in Bristol.

GLASGOW.

At an informal meeting of the Section held on March 9, Mr. J. H. Young presiding, Mr. Crooks read a paper on the "Electric Charge on Colloids." Reference was made to the importance of Colloid Chemistry and the growing necessity for all technical chemists to have a sound knowledge of the subject in view of the fact that many of the processes which the chemist controls deal with colloidal phenomena. The work of Graham was mentioned, and emphasis was laid on the fact that the term "colloid" connotes a "state" and not a "form" of matter, and that many of Graham's crystalloids have, by various methods, been obtained in the colloidal state.

Malfitano's work on the conductivity of sols after filtration through a collodion membrane was referred to, but it was pointed out that his method was open to objection as the filtration might change the concentration of the medium as well as remove the disperse phase. The method of prolonged electrolysis used by Whitney and Blake was recommended as a more suitable method. The necessary precautions to be taken in observing migration velocities were fully discussed. The action of electrolytes on sols was described and the "Valency Rule" generalisation enunciated and explained. Burton's estimation of the charge on a colloid particle (by assuming that the amount of aluminium ion necessary to precipitate a certain amount of a sol carried the same amount of positive electricity as the precipitated colloid did of negative) was also dealt with. In concluding, reference was made to the theories regarding the electrical charge, particular attention being given to the "differential diffusion" explanation of Taylor, the more or less generally accepted "adsorption" explanation, and Burton and Hardy's explanation for the oxidisable and non-oxidisable metals.

A paper on "Lead Corrosion" was read by Mr. W. G. McKellar.

NEWCASTLE.

Two papers were read at the meeting held on March 23. Mr. C. F. Tidman re-read the paper on "Alcohol from Coke-oven Gas," which he had previously read at Middlesbrough on March 7 (*cf.* J., 1921, 103 R), and Mr. C. L. Haddon contributed a paper on "The Effect of Some Physical Conditions on Calcium Sulphate Cement." Prof. P Phillips Bedson presided.

Mr. Haddon has carried out tests on the expansion of a flooring plaster consisting of 3 parts of plaster to 1 part of water or of a 5 per cent. solution of calcium chloride, potassium sulphate, or ferrous sulphate. Le Chatelier's apparatus was used, and no measurements were made with the cement in a plastic state. He found that expansion was least with accelerating solutions and greatest when retarders were employed. With the potassium sulphate solution, wet-set plaster continued to expand during recrystallisation. Both the degree of wetness and the amount of expansion have an effect on the tensile strength; briquettes which had expanded 5 per cent. had less than a quarter of the strength of similar briquettes allowed to dry in air (when the expansion is very much less). Under normal conditions, expansion does not exceed about 0.1 per cent., and ceases within the time required for complete setting.

The weakening of flooring plaster was investigated by immersing briquettes (after six hours' immersion in water and air-drying) in various liquids for definite times and then breaking them. It was found that mineral oils were without effect, but the tensile strength was reduced by mixtures of methylated spirit and water to an extent varying with the amount of water in the mixture. The strength was reduced by over one-half by water and by a concentrated solution of calcium sulphate. Similar results were found for crushing strengths.

The value of the published data on the mechanical strength of flooring plaster is impaired by the circumstance that no standard has been laid down concerning the condition of the briquette on breaking, and it is suggested that the method used in testing Portland cement should be generally adopted, and that the proportion of flooring plaster to water should be 3:1 by weight.

MANCHESTER.

The annual meeting was held at the Textile Institute, Manchester, on April 1, Mr. John Allan presiding. Five members of the committee retired, and as there were seven nominations to fill the five vacancies a ballot was taken; Messrs. R. H. Clayton, J. R. Hannay, W. B. Hart, J. A. R. Henderson, and J. Huebner were elected.

The Hon. Secretary, Mr. L. Guy Radcliffe, then read his report for the session 1919–21, which stated that the original syllabus, issued last August, arranging for eight meetings and about twelve papers, had been carried out with very few alterations. The change of meeting-place from the Grand Hotel to the Textile Institute, which was decided upon by a unanimous vote of the members present at the February meeting, has had the success anticipated, and the Section has now the advantage of an excellent locality for scientific meetings and social intercourse. The numerical strength of the Section has diminished in spite of many new members having joined the Society. About 20 members were lost by resignations, and 5 by deaths, but removals from the district were very numerous, and the membership now stands at about 620. The committee has elected Dr. E. Ardern to be chairman in place of Mr. John Allan, who now becomes vice-chairman in succession to Mr. W. Thomson, and the hon. secretary was re-elected for a further year. The report also refers to the annual dinner held in November and the annual supper held in March.

At the ordinary monthly meeting which followed, Mr. H. J. Bailey, formerly of the Explosives Department of the Ministry of Munitions, read a statistical paper on "Sulphuric Acid during the War Period." It was shown that whereas the production of sulphuric acid in the United Kingdom is normally about one million tons per annum of 100 per cent. strength, 1,208,000 t. was produced during 1916 in chamber-acid plants; and that the production of concentrated or fuming sulphuric acid made in contact-acid plants reached 221,000 t. during the year 1917.

The raw materials for the manufacture of sulphuric acid were dealt with, and tables were given showing the various main uses in the heavy chemical industries of the country. In addition, summarised statistics were given of the consumption of sulphuric acid in the manufacture of the various types of explosives, and it was shown that in the period 1916 to 1918 the overall consumption per lb. of explosive manufactured was reduced to less than one-half of that used during 1915 by obtaining increased efficiencies and necessary economies in working.

The author also discussed the production and use of fertilisers during the stressful period of the submarine menace in 1917–18, and showed that whereas during the first two years of the war the manufacture had seriously declined, before the war had ended the full pre-war production had been surpassed, thus enabling much larger supplies of sulphate of ammonia to be available for agriculture.

LONDON.

At a meeting held on April 4 at Burlington House, with Mr. Julian L. Baker in the chair, a paper entitled "The Scientific Principles of Cold Storage" was read by Prof. W. Stiles.

Food materials that can be preserved by cold storage—and they are the majority—may be roughly divided into:—(a) Those, such as fruit, which deteriorate on freezing and therefore must not be cooled below 0° C.; and (b) those, such as mutton and rabbits, which, after being frozen solid, practically revert to their original condition on thawing. A few materials, *e.g.*, beef and some species of fish, occupy an intermediate position. Cold storage above 0° C. allows enzyme and other actions, which may lead to deterioration, to continue, but below this temperature these processes are stopped or greatly retarded. Further advantages of frozen storage are:—Longer preservation, the possibility of close packing, and the small amount of supervision required. One of the greatest problems of cold storage is therefore to devise means by which materials belonging to class (a) may be stored in a frozen condition instead of at temperatures above 0° C.

The cold storage of fruit is influenced by variation in the rate of cooling, light, relative humidity, movement of the air, and other factors. Even at 0° C. biochemical changes take place which result in the conversion of carbohydrates and organic acids into other substances, and the production of carbon dioxide by respiration. The rate of respiration is greatest in those fruits that keep in cold storage for the shortest time, and this rate is doubled for an increase of temperature of 8° C. Although chemical changes are reduced by cooling, all reactions are not depressed to the same extent. Fruit may be chilled slightly below 0° C. without freezing, owing partly to the lowering of the freezing point by the salts etc. present in the juices, and partly to the effect of the small amount of heat produced by respiration. When rotting commences the temperature of the fruit increases rapidly. In storage by freezing, the change from liquid to solid is not completely reversible on thawing, and with beef and fish, water separates which runs out on thawing, thus leading to loss of soluble substances and probably causing toughness. The rate of cooling much affects the condition after thawing, and experiment has proved that with rapid chilling the changes produced are reversible on subsequent thawing. Although agitation of the cooling medium has little effect upon the rate of cooling, this property is largely influenced by the conductibility for heat of the medium. Gases are unsatisfactory, and the most efficient practicable media are water and aqueous solutions of common salt, calcium chloride or magnesium chloride. Materials of small bulk, such as fish or small joints of meat, are very effectively frozen in brine, but with larger pieces the outer layers are often dull in colour, although the salt present is insufficient to affect the flavour after cooking. Calcium and magnesium chlorides may give rise to a bitter flavour. But little experimental work has so far been done in this subject, and its extension would prove of the greatest value to all civilised races.

JAPANESE CHEMICAL INDUSTRIES FROM THE STANDPOINT OF FOREIGN TRADE.

As is well known, the chemical and allied industries of Japan underwent a sudden and great development during the war, owing mainly to the country being cut off from extraneous sources of supply, but also to the great demand for warlike materials. The progress achieved is well reflected in the following statistics of foreign trade, which afford a comparison between the average yearly trade during the three years immediately preceding the war and the trade in 1918. During this period the value of the imported chemicals, etc. rose from 63 million to 93·4 million yen, an increase of 47 per cent., and that of the exports increased from an average of 51·56 to 246·79 million yen, a gain of 378 per cent. The appended table gives some details (the negative sign indicates a decrease, and the yen is taken at 2s.):—

	Imports.			Exports.	
	Total inc. or dec.	Rate per cent.		Total inc. or dec.	Rate per cent.
Sugar	£216,200	356	..	£1,385,000	133
Leather	111,300	36	..	940,000	753
Oils and waxes.. ..	181,300	39	..	3,420,000	426
Chemicals and drugs ..	2,394,600	227	..	2,856,900	474
Explosives	160,900	183	..	1,708,200	150
Dyestuffs	417,600	58	..	—	—
Pigments	129,900	95		1,024,800	2601
Paints	27,400	16			
Rubber	−104,600	−42	..	—	—
Celluloid	−426,000	−100	..	—	—
Photographic materials	101,800	104	..	—	—
Paper	502,900	45	..	2,654,100	857
Porcelain	−1,800	−18	..	1,413,500	242
Glass	−134,600	−42	..	1,296,600	416
Enamelled ware ..	−3,800	−100	..	—	—
Bricks	−400	−2	..	—	—
Cement	—	—	..	560,200	1376
Electric-furnace products	117,400	970	..	—	—
Fertilisers	−1,269,200	−98	..	21,900	32
Total	£2,985,400	47%		£19,522,800	378%

It will be observed that very remarkable increases occurred in the imports of chemicals and drugs, dyestuffs, paper, sugar, oil and wax, leather, explosives, pigments, photographic materials, and electric-furnace products. On the other hand, celluloid, enamelled ware, and fertilisers all showed noteworthy decreases. Of the chemicals, very large quantities of soda ash, caustic soda and soap were imported, although production has increased to such an extent that at the present time Japan can supply 80 per cent. of her consumption of caustic soda from home sources. The increases shown are to a very large extent due to the enormous rise in market prices; the quantities imported actually diminished.

The following figures show the percentage value of the imported chemical products compared with the total value of the whole import trade of the country:—

		Average of 3 pre-war years.		1918.
(a) Total imports ..	..	£61,990,500	..	£166,814,200
(b) Technical products	..	—	..	67,386,700
(c) Chemical products	..	6,354,900	..	9,340,300
Ratio of (c) to (a)..	..	10.1%	..	5.6%

The largest increase in the value of exported products was obtained by the oil and wax industry, mainly as a result of the new export trade in palm oil, rapeseed oil, and soap. The chief increases in chemicals and drugs were in calcium carbide, acetic acid, and potassium chlorate. The ratio of the average value of the chemicals, etc. exported before the war to the whole export trade rose from 9·6 to 12·2 per cent.:—

		Average of 3 pre-war years.		1918.
(a) Total exports ..	..	£53,562,500	..	£196,210,000
(b) Technical products	..	—	..	£172,890,000
(c) Chemical products	..	5,156,500	..	24,679,400
Ratio of (c) to (b)..	..	—	..	14.1%
Ratio of (c) to (a)..	..	9.6%	..	12.2%

The most important countries of destination of exported Japanese chemical products are China, India, Oceania, and South America.

THE INTERNATIONAL NORMAL WEIGHT FOR THE SACCHARIMETER.

At the present time the normal weight that is in almost universal use for the saccharimeter (or polarimeter reading the percentage of sugar directly) is 26·0 grams, this standard having been adopted by the International Commission for Uniform Methods of Sugar Analysis in 1900. On dissolving 26·0 grams of pure sucrose in water, and making the liquid up to 100 metric c.c. at 20° C., a solution is obtained which in a 200-mm. tube reads exactly 100·0 scale divisions corresponding with $34{\cdot}657 \pm 0{\cdot}023$ angular degrees with spectrally purified sodium light. In France a normal weight of 16·29 grams is largely used.

The proposal was, however, recently made by Dr. C. A. Browne and other American chemists to adopt a sugar scale having a normal weight of 20 grams, the principal advantages claimed being:—(1) It is a compromise between the 26·0 and 16·29 gram scales; (2) the results obtained are easily converted into percentages by multiplying by 5; (3) aliquot portions of 50, 25, 20, and 5 c.c. of the 20 per cent. solution represent even gram quantities; and (4) the specific rotation of sucrose at a concentration of 20 grams. in 100 c.c. (18·62 per cent. by weight) is about the maximum. It was further argued that the factor for conversion into circular degrees, namely $100 = 34{\cdot}657$, is inaccurate in view of the work of Bates and Jackson published in 1916, and that the present is an opportune time for adopting a new factor and a new standard. French chemists decided to support their American colleagues in adopting the 20 gram normal weight.

In order to elicit the opinion of British chemists in the matter, a committee was formed consisting of the following:—Prof. Arthur R. Ling (chairman), Prof. Thomas Gray, and Messrs. L. J. de Whalley, Hugh Main, and J. P. Ogilvie (secretary). This committee drew up a statement of the arguments *pro et contra*, nearly 2000 copies of which were sent to chemists engaged in the sugar and allied industries, both in this country and in the British Dominions.

An analysis of the replies received shows about 72 per cent. of the correspondents to be opposed to the adoption of the new standard. Most of these replies stated as the reason for the decision that the advantages claimed for the proposed new standard were too slight to compensate for the considerable inconvenience, expense, and confusion that would (it was considered) be involved by its adoption. A very frequent additional reason was that, owing to the smaller amount of sample taken for the assay, the accuracy of observation would be diminished. In an addendum to his reply, Mr. A. F.

Blake, Chief Chemist, Atlantic Sugar Refineries, Ltd., St. John, N.B., Canada, said that he thought the 26-gram value should be retained regardless of whether Herzfeld's or Bates and Jackson's factor is the correct one, or whether future investigations provide still another, "new instruments being made according to the best factor available at the time, and old ones being controlled and corrected by quartz plates standardised according to the latest factor."

It would therefore appear that British chemists are largely in favour of retaining the present international standard, which in fact is now in almost universal use (excepting in France and Mauritius).

CHEMISTRY AT THE INDIAN SCIENCE CONGRESS.

The Eighth Science Congress was held this year from January 31 to February 5, at Calcutta, under the presidency of Sir Rajendranath Mukerjee. About 150 papers were presented.

On February 1, Dr. E. R. Watson, Director of the Cawnpore Research Institute, gave an address on "Chemical Research for the Development of Industries in India." Speaking of the dye industry, he said that the amount of coal tar at present available was quite insufficient, but if more were produced he saw no reason why the industry should not thrive. He was not very hopeful about wood distillation, but white lead, potassium permanganate, and various other chemicals might be made cheaply. The manufacture of sulphuric acid was handicapped by the want of indigenous sources of sulphur. There was some talk of making it from natural sulphates, but it was very doubtful whether this would pay. Industrial alcohol could be prepared from grain. There were three classes of industries possible in India, viz., (1) iron and steel, (2) textiles, and (3) chemicals.

In the discussion that followed, Dr. H. K. Sen, who has had considerable experience in the manufacture of sulphuric acid and sulphates in India, said that unless there were State protection chemical industries could not stand competition from outside. Sulphuric acid of sp. gr. 1·84 was sold in England at 28s. per ton before the war, but it could not be manufactured in India for less than Rs.97.5 per ton (rupee=1s. 4d. at par). Nitric acid would cost 4·5 annas (6¾d. at normal exchange) per lb. Magnesium sulphate used to sell in Germany at Rs.1—8 per cwt., whereas it could not be manufactured in India for less than Rs.4—14 per cwt. Dr. Sen advocated the manufacture of industrial alcohol from calcium carbide, which, according to the calculations of Drs. Simonsen and Sudborough, could be manufactured in India at £6 per ton. He said that 1 ton of carbide would yield as much alcohol as 8 tons of potatoes, viz., 700 kg. Tertiary pyritic shale was mentioned as a possible source of sulphur for the manufacture of sulphuric acid. India produced 6000 tons of saltpetre and exported 4000 tons annually. Nitric acid could be manufactured from it cheaply if the by-product potash salts could be disposed of profitably. Dr. H. E. Watson, of Bangalore, remarked that the manufacture of one or two dyes would not do; either a large number should be made or none at all. He was in favour of manufacturing industrial alcohol from cellulose by a biochemical process. It should stand competition with petrol. Prof. Gilbert Fowler, of Bangalore, expressed the opinion that the proposed manufacture of dyes in India was hopeless; nor was the manufacture of sulphuric acid from gypsum possible in India on a commercial scale on account of the high temperature required. In Europe calcium sulphide and sulphate were waste products in the manufacture of soda, yet no one thought of making sulphuric acid from them. Industrial development must grow side by side with the solution of the food problem, which was of the utmost importance at the present time.

In the Section of Chemistry some two dozen papers on the pure or applied science were read or taken as read. The president, Dr. H. E. Watson, discussed the development of Indian chemical industry in his address. Taking into consideration the vastness of the Indian Empire and the difficulties of railway communication, he was not in favour of erecting large factories in one or two places. Small factories distributed all over the country would be more suitable. He tabulated all the industries, giving figures of merit to each and taking into consideration all the conditions as to raw material, labour, transport, demand, competition, etc. He found that the salt industry took the first place, and tiles and bricks came next. Then followed iron and steel, sugar, oil, cement, essential oils, drugs, milk products, etc. For wood distillation the conditions were unfavourable. Hardening of oil for edible purposes was quite possible. The manufacture of sulphuric acid would succeed if small contact-plants were erected in different parts of India. The soda industry could not stand competition from the Brunner, Mond or Magadi Soda companies. The manufacture of bichromate was possible, as there was a great demand for it in the tanneries. Cyanamide could be produced cheaply, but it would be very difficult to induce the Indian cultivator to use it as a fertiliser.

Messrs. G. J. Fowler and D. L. Sen described an investigation carried out on behalf of the Indian Munitions Board upon the bacteria associated with rice and other cereals, in order to study the sources of infection in starch factories, the consequent loss of starch, and allied questions. The bacillus employed by Weizmann for the manufacture of acetone and butyl alcohol from starch is very resistant and survives the ordinary cooking process, but unpolished rice carries a small quantity of an alkaloid which acts as a selective antiseptic and protects the rice from bacterial attack. Marked differences were observed between the behaviour of polished and unpolished rice even after cooking, and microscopic examination showed that the polished grain carried more organisms of greater variety. Rice can be sterilised by a dry treatment with sulphur dioxide, which, however, also inhibits germination; this is an advantage in the case of grain that is to be used for the manufacture of starch, but, of course, not for seed grain. Weizmann's bacillus can be isolated by making successive sub-cultures from an original unsterilised mash of grain into a sterile mash maintained for one or two minutes at 90° C. A very fair acetone fermentation is obtained after nine sub-cultures, showing that the isolation is a selective process rather than the acquirement of new characteristics by the organism in the course of generations.

Dr. Fowler, in conjunction with Mr. K. C. Srinivasiyer, found that sulphur dioxide was also a good antiseptic for use in the manufacture of glue and gelatin. In this case it must be in aqueous solution, the strength of which should be about N/8, equivalent to about 0·75 gm. of sulphur per kg. of the final product. It also clarifies the material and decolorises it. A paper by G. J. Fowler and B. Bannerji on the utilisation of *megasse* (the residue left after the pressing of sugar cane, now usually used as fuel) described how by hydrolysing it with dilute sulphuric acid under pressure a solution was obtained which, after the addition of some ordinary sugar, can be fermented for the manufacture of power alcohol. After heating under pressure with caustic soda the residual fibre can be worked up into cheap paper stock.

Another biochemical paper, by G. J. Fowler and M. Srinivasiyer, dealt with the indigo dye vat. Instead of hydrosulphite, the Indians add the seeds of "cassia tora" to reduce the indigo to indigo white. These seeds contain a sulphur protein and bacteria that ferment and produce hydrogen, which effects the change of the indigo. There is also a bitter substance which acts as a selective antiseptic restraining the growth of other bacteria.

RECENT DEVELOPMENTS IN THE ELECTROLYTIC PRODUCTION OF HYDROGEN AND OXYGEN.

A. J. HALE.

Much of the plant employed up to 1913 for generating hydrogen and oxygen by the electrolysis of water was composed of cells which had been designed prior to 1903, and although some improvements in design and efficiency were introduced during the two or three years before the war, the demand of the Allies for these gases was no doubt responsible for much of the activity recently displayed in this branch of industrial chemistry.

The cells on the market today, many of which have been devised during the last six years, may be classified as bell, filter-press, or unit type. Each cell is usually capable of taking 300—600 ampères, and the electrodes are placed near together to diminish electrical resistance. Apart from the filter-press bi-polar type, the tendency has been to develop the construction of flat-diaphragm units of maximum capacity which occupy a minimum of floor-space. These single units possess the advantage over the filter-press type that any cell in need of repair may be cut out of the series without stopping the remainder, whereas in the filter-press cells the whole group must be stopped while the repair is effected.

Bell Cells.—Under this head may be included all non-diaphragm cells, for the predominant idea in this type is to prevent the mixing of oxygen and hydrogen by encasing the electrodes in such a manner that the discharged gases are directed upwards to their respective mains. Sometimes the construction is unnecessarily complex, as in the Vareille cell (Fr. Pat. of 1905) and Tommasini cell (U.S. Pat. of 1912), and others; but the plant of the Hydrogen, Oxygen and Plant Co., based upon Jaubert's patents of 1916, and the Churchill cell (Pat. of M. Geeraerd of 1916) are of simple construction and reasonably efficient. Each of these cells gives over 6 cb. ft. of hydrogen per kw.-hr.; the former has been put down at several French factories, and the latter is used in several English works.

The principle of the Jaubert cell is shown in Fig. 1, taken from the patent specification. The cell consists of a rectangular heat-insulated tank, in which there are five pairs of electrodes connected in parallel. Each electrode is partly covered by a steel bell, and the dimensions of the bells and electrodes are in proportion to the volumes of gases evolved at each, *i.e.*, 2:1; but, as indicated in the diagram, the length of electrode exposed below the bell is inversely as the volume of gas evolved. Each cell is rated to take 300—600 ampères at 2·3—2·5 volts, and the purity of the evolved oxygen is 97·5—98·5 per cent. before passing through the purifiers.

The Churchill unit resembles a filter-press in construction but has no diaphragms. Each electrode plate is so constructed that the oxygen and hydrogen are prevented from mixing when discharged from adjacent electrode faces by vanes of insulating material which guide the gases upwards to their respective channels. Obviously any number of plates may be screwed together to make up a battery. The advantage claimed for this cell is that the absence of an asbestos diaphragm diminishes resistance considerably, so that only 2·0 volts is needed per cell.

Non-diaphragm cells are usually equipped with gas purifiers (consisting of heated platinum spirals) in order to increase the purity of the gases up to 99·5 per cent. or more.

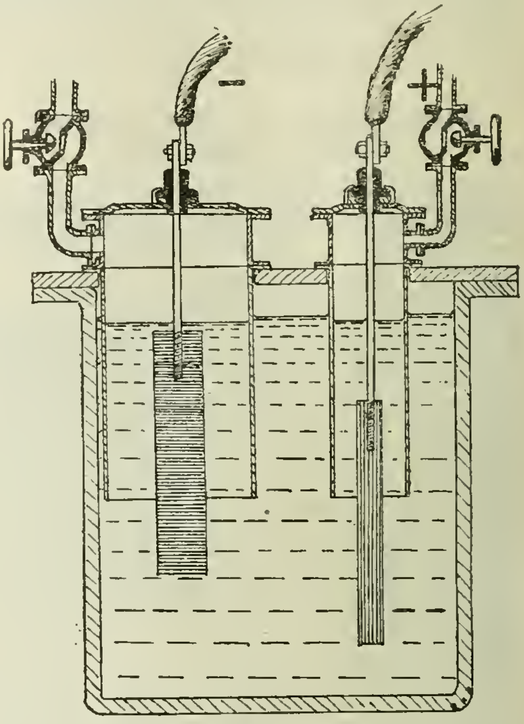


Fig. 1.

Filter-press Cells.—The design of this type is indicated to some extent by its name, and descriptions may be found in text-books on electrochemistry. Several firms have put this type on the market. The National Oxygen Company of Chicago effected improvements in the filter-press design in 1917, and the existence of numerous competitors of the Oerlikon cell (Schmidt's Patents) shows that this type has many points in its favour. Some care is needed in fitting the asbestos diaphragms and in screwing together the plates before starting up, but these are minor handicaps, and such plants have been in use for many years and given entire satisfaction to the users.

Diaphragm Unit Cells, sometimes known as tank cells, have of late been much improved and today represent the most perfect contrivances for producing oxygen and hydrogen by electrolysis. In the early type of cell (1911) manufactured by the International Oxygen Co., an iron tank formed both the containing vessel for a caustic soda electrolyte and the negative electrode. From the lid of this vessel was suspended an iron anode corresponding in shape to the outer tank and separated from it by an asbestos sack which depended from the lid. The kw.-hr. output was 7 cb. ft. of hydrogen of 99·7 per cent. purity.

An improved form of this cell is now made by the Davis-Bournonville Co., New Jersey. The kw.-hr. output is 7·5 cb. ft. of hydrogen, and the dimensions of a 500-ampère cell are: 13·5 in. × 24 in. × 46 in. in height; 1000-ampère units are: 15 in. × 36 in. × 51 in. in height. A gas purity of 99·5 per cent. is guaranteed, and, in addition, a speciality is made of automatic control throughout the plant which diminishes risk of accident and restricts the amount of supervision required.

The next stage in the development of the unit tank cell was reached almost simultaneously in England and America. A flat cell was designed in which the body consists of a stout steel frame of rectangular shape. On each side of the frame is clamped an iron sheet, one positive and one negative, the two being insulated from each other and separated by an asbestos-sheet diaphragm which divides the cell into two vertical halves, thus effectively preventing the mixing of the oxygen and hydrogen which are evolved when the cell is working. The cell of the Integral Oxygen Co. (Fig. 2) is of this type, and a study of its design and record of output will show that economy of floor-space and material is combined with high efficiency. Each cell covers a floor-space of 4 in. × 42 in., and the total over-all height, with piping, is about 7 ft.

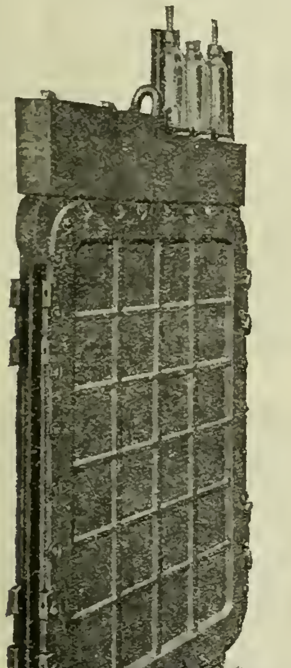


FIG. 2.

On the right side of the body shown is the nickel-plated cast-iron anode, and on the left is a similar iron cathode. The active surface of each plate is corrugated in order to give increased area and to facilitate the circulation of the electrolyte. It has been found necessary to plate the anodes of all electrolysers with nickel in order to avoid the formation of iron-oxide deposit, which speedily interferes with the efficient running of the cell and tends to block the pores of the diaphragm. Cast as parts of the head of this cell are a reservoir for electrolyte, proper channels for collecting the gases, and a simple arrangement of chambers and water-seals acting as an automatic internal-pressure equaliser. At the top of the diagram are shown an eye-bolt for raising and moving the cell, and three glass bells, of which the first is the hydrogen outlet, the second the feed for distilled water, and the third the oxygen outlet. These bells are protected by two iron uprights, the front one being an overflow pipe and the end one a standard, of which the function is entirely protective.

Each cell is rated at 600 ampères and 2·2 volts, and under these conditions gives 9·6 cb. ft. of hydrogen per hour. A battery of 50 cells takes up a floor space of 3 ft. 6 in. × 16 ft. 8 in., and with a current of 800 ampères at 2·4 volts will give 15,360 cb. ft. of hydrogen per 24 hours. The weight of the empty cell is 800 lb., and when filled with electrolyte 1000 lb., so that each holds about 20 gallons of water, one gallon of which will give about 160 cb. ft. of hydrogen.

The Levin cell (U.S. Pat. 1917), made by Electrolabs, Pittsburgh, Pa., is constructed on the same plan and is thoroughly efficient. A complete cell, which has the dimensions 30 in. × 25 in. × 6¼ in., is rated at 250 ampères, and weighs when empty 148 lb.; a larger type, 43 in. × 37 in. × 8½ in., rated at 600 ampères, weighs 325 lb., and gives 9·6 cb. ft of hydrogen per hour. There are three compartments, the two outer ones for generating oxygen, and the inner one for hydrogen. The three electrodes are independent of the casing of the cells, so that its construction differs in some respects from that of the cell last described.

Some idea of the efficiency of the various cells may be gained from the figures in the following table, which shows the output of hydrogen per kw.-hr. as well as the voltage needed for each cell and the guaranteed purity of the oxygen and hydrogen evolved:—

Cell.	Voltage required.	Hydrogen per kw.-hr. cb. ft.	Purity of Hydrogen Per cent.	Purity of Oxygen Per cent.
Oerlikon filter-press	2·2–2·4	6·0	99	97
National Oxygen Co., Chicago ..	2·0	7·4	99·5	99·3
Integral Oxygen Co.	2·2	7·3	99·5	99
Levin cell... ..	2·2	7·3	99·8	99·5
Oxy-hydrogen and Plant Co. ..	2·3	6·0	98	96
Churchill Cell. ..	2·0–2·2	6·5–7·0	99	98
Davis-Bournonville.	2·1	7·5	99·5	99

Cost and Lay-out of Plant.—In considering the cost of purchasing and running plant for producing hydrogen and oxygen, attention must be directed to several factors. Direct current is necessary, and this may involve the installation of generating plant for converting the alternating current supply. The gases will be passed to gas holders under a pressure of a few ounces and thence, by low-pressure compressors, to storage tanks at 300 lb., and, in the event of one or both gases being sold, high-power compressors will be needed, together with steel cylinders for bottling under a pressure of about 2000 lb. per square inch.

The layout of a complete plant would consist of the cell room containing the electrolysers, in close proximity to the generator room, if generators are needed. From here the gases would pass to the gas-holders, of the usual gasometer type, which are erected in a suitable position outside and a few yards away from the cell room, and capable of holding at least 12 hours' supply of gas. In a neighbouring house would be the compressors, one for each gas, and the compressing table for filling the cylinders used in transporting the gas to the ultimate user. If the gases are to be used on the works, low-power compressors should connect to storage tanks holding 1000—5000 cb. ft., from which pipe lines will distribute the gas to the work-benches.

The capital outlay involved may now be considered. The floor-space needed for cells to supply

5000 cb. ft. of hydrogen per 24 hours would be as follows:—

Type.	Floor-space.	Type.	Floor-space.
Integral Oxygen Co.	7'x3' 4"	Churchill.	40'x3'
National Oxygen Co.	13'x4' 6"	Hydrogen Oxygen & Plant Co.	50'x9'

The approximate cost of the electrolysers will be £1400—£1500 in each case, and for compressors, gasholders, etc., another 150 per cent. may be added. Electrolysers for generating 20,000 cb. ft. of hydrogen and 10,000 cb. ft. of oxygen per 24 hours will cost approximately £6000, and if the whole of the accessory plant be needed a total outlay of £15,000 may be involved.

An example showing the total cost of producing oxygen and hydrogen by this method may now be outlined, in which the costs quoted are certainly above the average.

Costs.

Plant to provide 5000 cb. ft. of hydrogen per 24 hours Initial outlay on cells, switchboard, generator, compressors and gasholders	£4,000

Annual Cost of Production.

300 days of 24 hours, hydrogen	1 500,000 cb. ft.
" " oxygen	750,000 cb. ft.
Energy per 1000 cb. ft. O_2 " 2000 cb. ft. H_2 } 300 B.Tr.U. at 1d.	25s. 0d.

Overhead Charges.

5% Interest on £4000	£200
Depreciation at 10%	£400
Attendance, 20 hrs. per day at 2s. per hour	£600
Annual cost of current, at 1d. per unit	£925
	£2125

Cost per 1,000 cb. ft. of oxygen (hydrogen being wasted) .. 56s. 0d.

If however both gases are utilised:—	per 1000 cb. ft.
Cost of oxygen	28s. 0d.
" hydrogen	14s. 0d.

Allowing for 200 cylinders at £5, *i.e.*, £1000, if gases are to be bottled and transported, the sum of £200 would have to be added to overhead charges for interest and depreciation at 20 per cent. In plants for oxy-hydrogen cutting the cost would be lower in labour, whilst low-power compressors only would be needed and no gas bottles, making a difference of £500, approximately, in capital expenditure.

The largest item is cost of current, but there are cases where this is cheap, or even surplus power.

The total in such a case might be £1500 for overhead charges. Hence cost of oxygen=40s. per 1000 cb. ft.; or if shared by hydrogen, 20s. per 1000 cb. ft. for oxygen, 10s. per 1000 cb. ft. for hydrogen. At the present time very many works are using the electrolytic process for generating oxygen and hydrogen, both in Europe and America. Among the uses to which the gases are being put are metal welding and cutting, hydrogenation of oils, manufacture of incandescent filament lamps, metal brazing, oxy-acetylene welding, smelting work, steel production, synthetic ammonia, accumulator works. The various Government aircraft stations are equipped with electrolytic generators, and the uses of the gases are extending rapidly.

Although it is a great advantage to utilise both gases on the spot, this is not always done, and sometimes the hydrogen, or even the oxygen, is run to waste.

An analysis of about 70 plants, put down on one system only, shows 18 works utilising both gases for their own manufactures, and 17 producing both gases exclusively for supplying outside consumers. Twenty are using only the oxygen, and the rest generally combine the use of one gas for their own needs with the sale of the other to outside consumers; but, obviously, on account of its value, oxygen is seldom run to waste.

The plant is comparatively simple in construction, is run with but little supervision, and generates the purest gases. The purity of the gases is sometimes the all-important factor, as in the hydrogenation of oils and in oxy-hydrogen cutting.

There can be no doubt that the electrolytic production of oxygen and hydrogen has a considerable future before it.

MEETINGS OF OTHER SOCIETIES.

ROYAL PHOTOGRAPHIC SOCIETY.

At the annual meeting of the Society held on March 8, Dr. G. H. Rodman was elected president for a second year, Sir William Pope and Mr. W. L. F. Wastell were elected vice-presidents, and most of the members of the old council were reappointed. The report of the year's work showed an exceptionally large accession to the membership. This will afford considerable financial relief to the Society, whose expenses naturally reflect the changed conditions produced by the war; the subscription is being raised only to those members joining after 1920. The Society's Progress Medal was presented to Mr. F. F. Renwick "in recognition of his researches in the chemistry and physics of photography." Previous recipients of the medal include Abney, Hurter and Driffield, and the Lumières.

The meeting of the Scientific and Technical Group, held on March 15, was devoted to reflex cameras. Mr. Newman gave a short sketch of the history of this form of camera, including a statement of the most important mechanical requirements and the usual methods of meeting them. Major A. Abrahams described the use of the camera in high-speed photography, especially of rapidly moving objects.

SOCIETY OF GLASS TECHNOLOGY.

During the forenoon of the meeting held in Newcastle-on-Tyne on March 16, a visit was paid to the works of Messrs. Lemington Glassworks, Ltd., Lemington-on-Tyne, to see the manufacture of electric-lamp bulbs and glass-tubing. Of especial interest were the Westlake automatic machines, which turn out bulbs at the rate of 1000 per hour.

The first paper at the afternoon meeting was a "Note on the Corrosion of Fireclay Refractory Materials by Glass-making Materials," by Mr. D. Turner and Prof. W. E. S. Turner. The authors found that even at 800° C. soda ash attacked fully-burnt fireclay, and that particles of a certain size lost 11 to 18 per cent. of their weight within three hours. Salt cake was not nearly so active as soda ash, as it took up only 1 per cent. of the fireclay at 800° C. The results indicated a direct correlation between the corrosive action of alkali salts and their temperature of decomposition, those decomposing at the lowest temperatures, *e.g.*, nitrates, being the most corrosive.

In a paper on "The Clouding of Glass," Dr. M. W. Travers described a research undertaken to determine the causes of the clouding of soft soda-glass during lamp-working operations at a short distance from the hottest zone. As no clouding effect was observed when pure hydrogen and air were used, he concluded that clouding was associated with some impurity in the gas, and further experiments showed that sulphur dioxide was the chief cause. The remedy lay in purifying the gas from sulphur, as was practised by the South Metropolitan Gas Co. Mr. W. W. Warren drew attention to the difficulty caused by the presence of sulphur in the working-pot of the Westlake machine, and Mr. F. F. S. Bryson stated that the Glass Research Association had been considering the same problem.

A paper by Miss E. M. Firth and Prof. Turner on "The Shrinkage, Porosity, and Density of British Fireclays after Firing at 1500° C." was postponed owing to lack of time.

Prior to the reading of the papers the chairman, Dr. Travers, referred to the death of Lord Moulton, and it was unanimously resolved to record in the minutes the Society's appreciation of the great services he had rendered to science.

THE FARADAY SOCIETY.

A meeting of the Faraday Society was held in the rooms of the Chemical Society at Burlington House on March 22, when Prof. A. W. Porter delivered his presidential address on "The Scientific Work of the late Lord Rayleigh."

Lord Rayleigh was the first vice-president of the Faraday Society, and but for ill-health he would have been its president. His interests in physics were very wide, and the recently published collection of his researches contains more than four hundred papers. He was equally distinguished as a theorist and as an experimentalist, and though some of his experimental work necessitated most elaborate apparatus requiring consummate skill for its design and use, he always took the keenest delight in the design of the simplest apparatus with which most valuable results could be obtained. Considering some of Lord Rayleigh's elaborate experimental work, Prof. Porter pointed out that, although at the beginning of his work the absolute value of the ohm was only known to within 4 per cent., his classical determination gave a value differing by only 1 part in 10,000 from the most recently determined figure. Similarly, he determined with certainty the fourth figure of the electrochemical equivalent of silver, although the previous work had left an uncertainty of 2 per cent. Another example of this type of work was the famous discovery of argon.

Turning to the simpler experimental methods, Prof. Porter mentioned the simplification introduced into interferometry by abolishing the necessity for an accurate parallel movement between two plates. Another interesting observation was that the fouled surface of a liquid may be cleaned sufficiently for conducting surface-tension measurements by the simple expedient of scraping it with a piece of paper or with an expanding ring.

Referring to Lord Rayleigh's interest, from 1871 onwards, in the problem of the colour of the sky, the speaker foreshadowed useful developments of his work which he hoped would soon be published by Captain Paris. Lord Rayleigh also explained the cause of the gorgeous colours often to be seen in crystals of potassium chlorate, and the arguments he adduced are applicable to the reflection of X-rays by crystals.

In his work on capillarity and the intrinsic pressure in liquids, Lord Rayleigh did not consider very deeply the theoretical aspects of the phenomena or make much advance on the ideas of Laplace. Prof. Porter then showed that if the assumption be made that the force of attraction between two atoms, whose centres are at a distance of r from each other, varies inversely as r^n, and if it be assumed that the value of r can never become less than a fixed quantity σ, then measurements both of surface tensions and of intrinsic pressures show that n must be about 8·3. It was, however, necessary to point out that it is improbable that the centre of the atom can be regarded as the centre of the attraction.

Lord Rayleigh was always keenly interested in hydrodynamics and made extensive use of the method of dimensions, a particular case of which is known as "the principle of dynamical similarity." When this is applied to the sand-blasting of glass, it is readily seen that, on the assumption that rupture occurs when a particular stress is exceeded, independently of its duration, the rupture of the glass depends on the velocity of a particle of sand, and not on its size.

Mr. S. Field read a comprehensive paper on "The Electrolytic Recovery of Zinc," in which he described the state of the zinc industry both at home and abroad, and discussed the relative merits of the electrolytic and distillation processes. A detailed account of the electrolytic process followed, together with figures of working costs. The author believes that the employment of electrolytic extraction, by rendering possible the use of low-grade ores, might ameliorate the present depressed state of the industry in Great Britain and increase the national wealth. Mr. W. E. Hughes presented the first part of a paper on "The Forms of Electro-deposited Iron and the Effect of Acid upon its Structure," which dealt only with deposits from a bath composed of ferrous and calcium chlorides. The author showed that the structures found in iron deposits formed in such a bath are varieties of two general and distinct types—the normal and the fibrous—the latter being characteristic of deposits formed in acid or in agitated solutions. It was further shown that macroscopic features correspond with a macroscopic structure, a fact which may be used to facilitate control of the process. The last paper, by Prof. Alex. Findlay and Mr. V. H. Williams, was entitled "Notes on the Electrolytic Reduction of Glucose." Negative results were obtained in an attempt to obtain by electrolysis the hexahydric alcohol corresponding with glucose; both with graphite and with lead electrodes, glucose is reduced to formic acid and a pentose.

SOCIETY OF PUBLIC ANALYSTS.

A meeting was held in the Chemical Society's Rooms on April 6, Mr. A. Smetham presiding.

In a paper on the "Estimation of Strychnine in Scale Preparations containing Quinine and other Cinchona Alkaloids," Messrs. T. F. Harvey and S. Back discussed existing methods for separating strychnine and quinine which are only of limited value. The method recommended by the authors is based on the tartrate method of Harrison and Gair and on the ferrocyanide method of Simmonds. The greater part of the quinine is directly precipitated as tartrate from an aqueous solution of the scales, the strychnine and residual quinine are extracted from an aliquot part of the filtrate, and the strychnine is then precipitated as ferrocyanide. Characteristic residues are usually obtained. With the exception of quinicine, the behaviour of which was described, the presence of small quantities of other cinchona alkaloids is not detrimental.

Mr. J. L. Lizuis described "A Method for the Determination of the Acidity of Coloured Solutions," which consists in approximately neutralising the solution, filtering through a paper previously treated with the indicator solution, adding small quantities of standard alkali or acid, and refiltering, the procedure being continued until the filter paper gives the permanent coloration of the indicator.

"The Action of Water on Lead" was dealt with by Dr. J. C. Thresh, who referred to the conflicting views held on this action. He has found that water free from dissolved oxygen has no action on lead, but if free oxygen be present, action begins forthwith and continues until all the oxygen is used up, the rate of action depending on the amount of oxygen present. Theoretical explanations of the reactions involved were given.

A paper on "A Colour Reaction for Aconite" was read by Dr. S. Mellaneh, who stated that the colour reactions at present known for aconite were really those of benzoic acid, and that colour reactions generally were seldom useful unless applied to pure alkaloids. The author has devised a very delicate test for aconite, involving the use of potassium ferrocyanide and formic acid. The method is apparently specific, but confirmation is being sought; it is applicable not only to the pure alkaloid, but also to the powdered root, and the author recommends it for medico-legal work, particularly in India.

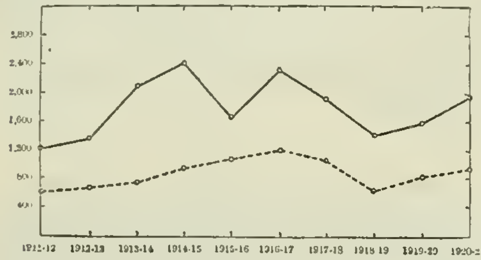
NEWS AND NOTES.

BRITISH INDIA.

The Groundnut Crop of 1920-21.—The final general memorandum on the groundnut crop of the season 1920–21 states that the total yield is estimated at 931,000 tons of nuts in shell, as against 822,000 t. last year, or an increase of 13 per cent. The total area returned is 1,951,000 acres, as compared with 1,586,000 in 1920, or an increase of 23 per cent. Of the total area under this crop in British India, 75 per cent. is in Madras, 13·5 per cent. in Burma and 10·5 per cent. in Bombay.

Area and Yield of Groundnuts, 1911–12 to 1920–21.

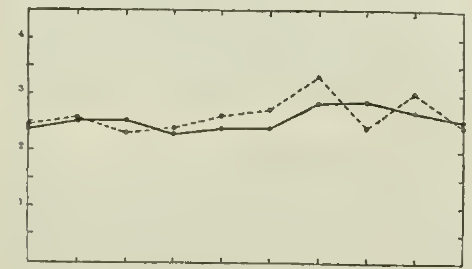
Area (in thousand acres) —— Yield (in thousand tons) – – –



The Sugar-Cane Crop of 1920-21.—The area sown to sugar-cane is estimated at 2,553,000 acres, or 5 per cent. less than a year ago, when it was 2,686,000 acres. The estimated yield of raw sugar (*gúr*) is 2,465,000 tons, compared with 3,036,000 t. last year, or a decrease of 19 per cent. Owing to deficient rainfall in certain of the producing provinces, the season has not been favourable, on the whole, for the crop sowing. The chief contributors to the total yield are:—United Provinces 52·4 per cent., Punjab 16·5 per cent., Bihar and Orissa 10·5 per cent., Bengal 8·7 per cent. and Madras 4·2 per cent. The appended chart illustrates the estimates of area and yield, as compared with the final figures for the preceding nine years.

Area and Yield of Raw Sugar, 1911–12 to 1920–21.

Area (in million acres) —— Yield (in million tons) – – –



—(*Indian Tr. J., Feb.* 25, 1921.)

Cinchona and other Medicinal Plants.—The vital need of possessing within the Empire essential raw materials, such as quinine, was strikingly brought home to us during the war. In 1914 Germany, one of the most important manufacturing and distributing countries, had full stocks in hand, with facilities for securing (during the early stages of the war) enough of the raw product to meet the wants of herself and her partner-in-arms. On the other hand, the supplies of the Allies were none too plentiful, and from the first they were dependent on the goodwill of Holland, which had, and still has, the virtual monopoly in her Java cinchona plantations. The Dutch, however, needed coal, machinery, and rice from Burma, so the result was a collective bargaining by the Allies and the signing of an agreement for the supply and distribution of quinine by the Dutch Quinine Combine and the Association of Quinine Manufacturers in Allied countries. This agreement was faithfully kept—although at some pecuniary sacrifice to the Dutch—until the end of the war. After the armistice the short supply of quinine led to hectic speculation by holders in second and third hands, and Government control became impossible. After decontrol prices became more stable, and at the present time the British Quinine Corporation, working in conjunction with the Dutch Combine, practically controls the British quinine market. Although prices have declined as a result of decontrol, the production of bark and quinine as a lucrative commercial proposition is apparently more firmly established than ever before. There is, therefore, a growing interest in cinchona cultivation in America, Japan, and within the British Empire.

An important scheme for developing the production of quinine in India was initiated during the past year, of which an account is given in the report on the Government Cinchona Plantations and Factory in Bengal for 1919–20, published in the *Calcutta Gazette* of December 8, 1920. According to this report it is probable that Burma will in time become an important source of the drug for India or the Empire. Owing to the strain of the war period, cinchona crops in Bengal have been much reduced. In 1919–20 the yield was 513,043 lb., and a still smaller harvest is anticipated for 1920–21; but this is all to the good of the plantations. The total area under cinchona is 3080 acres, of which 2319 acres is comparatively young. There are approximately 3,610,000 cinchona trees on Munsong estate and 1,480,000 on Mungpoo, making a total of 5,090,000. During the year under review 149,835 lb. of Mungpoo bark and 334,410 lb. of Munsong bark were worked up, besides 514,540 lb. of bark obtained from Java for the Government of India. These showed on analysis a total of 20,588 lb. quinine sulphate on the Bengal grown bark and 31,571 lb. on the imported bark. The products actually obtained were 47,724·25 lb. of quinine sulphate, 1022 lb. of hydrochloride (equivalent to 1160 lb. of sulphate), and 15,166 lb. of cinchona febrifuge (containing quinine equivalent to 2226 lb. of sulphate), making in all an average yield of 98 per cent. on analytical results. The total cost of the total harvest was Rs. 97,497, but the actual market value was Rs. 2,74,670; and it is pointed out that the purchase of the same quantity of bark in the market would have cost the Government Rs. 1,77,174 (*plus* freightage and carriage charges) more than it actually did.

Ipecacuanha, digitalis, and belladonna are being grown experimentally in Burma. Of the first-named, 76,000 plants are being cultivated, and during the past year the older plants seeded well and all the seed has been sown. It is still uncertain if the cultivation of ipecacuanha can be made to pay. The digitalis crops at Mungpoo did very well until heavy hail storms destroyed 50 per cent. of the leaf. To obviate this havoc in future, a portion of the 1920–21 crop will be planted in partially-cleared forest only. European methods of drying the leaf have been employed successfully, and the product is of high quality. Moreover, with digitalis at its present price the requirements of India could easily be met by home-grown supplies. The cultivation of belladonna is only in its infancy, and good results are expected, but chenopodium culture has been discontinued owing to the low yield of oil. The collection of lycopodium from the natural supply on Mungpoo has also ceased as there is apparently no demand.

Department of Industries.—A Board of Industries and Munitions was constituted in February, 1920, as a temporary organisation to close the war commitments of the Indian Munitions Board, to take over some of the work of the Commerce and Industries Department and the Public Works Department, and to start the organisation of the new Department of Industries. This it has done, and consequently the board was merged into the new Department by a resolution of the Government of India dated February 15, 1921. The new department is under the charge of the Hon. Sir Thomas Holland, who is a member of the Governor-General's Executive Council.

The Development of the Indigo Industry in Assam in conjunction with Tea and other Crops is the title of Indigo Publication No. 8, of the Agricultural Research Institute, Pusa, written by Mr. W. A. Davis, Indigo Research Chemist to the Government of India.

Java indigo grows more luxuriantly in Assam than in Bihar, the yield of unusually high-quality green plant and seed per acre being extraordinarily high. Bihar has been almost entirely dependent on the United Provinces and Assam for its supply of indigo seed since the war. A small indigo factory was installed on the estate of the Panchnoi Tea Co. in 1919, and the yield of plant per acre, the leaf percentage on the weight of the plant, and the indigotin content have proved unusually high. In Bihar the bacterial-steeping conditions are usually good and give rise to a 70 per cent. efficiency of extraction, but in Assam the yield and quality of the indigo at first obtained were so poor, owing to the difficulties caused by green vats and bad settling, that the enterprise appeared likely to prove a failure. These difficulties have been traced to the fact that the water used for steeping at Panchnoi was obtained from a small river rising in the hills only a few miles away. The bacterial character of this water changed very rapidly with variations of rainfall in the hills; the water was very soft and, as a rule, was extraordinarily deficient in the indican-hydrolysing types of bacteria which are essential for good steeping results. An increase in the duration of steeping at Panchnoi gave much better results, the difficulty of green vats and bad settling disappeared entirely, and a very high yield of greatly improved quality was obtained. It is of the greatest importance to ascertain at each factory in Assam the duration of steeping each day which gives rise to the maximum produce and quality, and a simple colorimetric test has been devised for this purpose which permits the production in Assam of high-quality indigo, well up to the Bihar standard.

The profits to be derived from growing indigo in Assam are considerable, and with favourable working the product could not only compete with synthetic indigo, but displace it completely from the market. In addition the great value of the seet, or refuse from the steeping vats, as a rapid-acting nitrogenous manure for promoting the leaf-growth of other crops must be taken into account. The growth of indigo in Bihar is so poor that the seet obtained from 4—5 acres of indigo land only suffices to manure 1 acre of land, whereas in Assam, owing to the luxuriant growth of indigo, the seet from 1 acre would be sufficient to manure 1 acre of land. Indigo could be grown with great advantage on newly-opened or newly-cleared tea-land, and would enable considerable profits to be made in the preliminary 4—5 years before the tea bears. Seet has also proved an admirable manure for sugar-cane, the growth of which in Assam is likely to develop considerably in the future, and indigo could be grown with particular advantage on newly-opened sugar estates. The growth of flax in conjunction with indigo in Assam is also worthy of consideration, for the flax could be grown and manufactured in the cold weather, the indigo vats would be suitable for retting, and this crop would utilise labour advantageously in the off-season. In China and Japan there is an immediate and considerable market waiting to be supplied with indigo in the proper form, *i.e.*, a stable 20 per cent. paste such as can now be prepared readily. It is of the greatest importance that the output of natural indigo from India should be increased as rapidly as possible, for the present annual output from Bihar is less than 5 per cent. of the requirements of China and Japan.

FRANCE.

Organisation of Chemical Societies.—At the last general meeting of the Société de Chimie Industrielle, M. Paul Kestner, president, reviewed the work of the Society, put forward certain proposed modifications in its constitution, and explained its relationship to other French chemical organisations. The modifications include the formation of groups or sections corresponding to the various branches of applied chemistry; each group will appoint a president, vice-president, and secretary to hold office for three years, who will report monthly to a full meeting of all members of the group; and there will be a general meeting of all the groups once a year. The proposal to publish a joint abstract journal for pure and applied chemistry has been abandoned, and it has been agreed that the State subsidy granted for this purpose shall be shared by the *Bulletin de la Société Chimique* and *Chimie et Industrie*, which will publish abstracts in pure and applied chemistry, respectively.

The three chief chemical organisations in France are:—(1) Le Comité National de Chimie, which co-ordinates research work in pure and applied chemistry with a view to assisting Le Comité National des Recherches. (2) La Fédération Nationale des Associations de Chimie, founded in 1919 to co-ordinate the scientific, technical and economic activities of the following seven societies: La Société Chimique de France, La Société de Chimie Industrielle, L'Association des Chimistes de Sucrerie et de Distillerie, La Société des Experts Chimistes, La Société de Chimie physique, La Société de Chimie biologique, and L'Association des Chimistes de l'Industrie textile. (3) L'Union Internationale de la Chimie Pure et Appliquée, also founded in 1919, and L'Office Internationale de Chimie, the functions of which were detailed in our issue of July 31, 1920 (p. 251 R).

Industrial Notes.—*Chemical Industry.*—Except for a more active inquiry for superphosphate, market conditions remain practically unchanged. The factories have reduced their production by 40—50 per cent. The Lyons Fair was again a great success, and it is reported that most probably Lyons will become the centre of all fairs in France, and thus take the place of Paris, where in future a yearly exhibition of artistic products will be held. Lyons will be to France what Leipzig is to Germany.

Metallurgy.—The production of cast iron in France during 1920 was 3,317,371 metric tons, of which 1,355,000 t. came from the recovered province of Lorraine; this compares with 5,311,316 t. in 1913 (exclusive of Lorraine). Of steel, 2,961,508 t. was produced, including 1,098,000 t. from Lorraine, against 4,635,166 t. in 1913. Although inquiries are more numerous the metallurgical market shows no decided improvement, and prices remain uncertain as no decision has yet been reached concerning the price of metallurgical coke.

Cotton Cultivation.—The cultivation of cotton is progressing very well in the French colonies; Algeria, in particular, is making good headway and will soon have about 2700 acres under cultivation. Great efforts are being made in Désirade Island, near Guadeloupe, as well as in French West Africa, in Togo, and in Cilicia.

The Window Glass Industry.—Owing mainly to the German invasion of Northern France the French production of window glass fell 75 to 80 per cent. during the war. Consequently imports of window glass, largely from the United States, increased very greatly, viz., from 3640 metric tons in 1913 to 8142 in 1915, 8612 in 1917, 47,900 in 1919, and 34,169 in the first nine months of 1920. The exports fell from 6116 t. in 1913 to 830 t. in 1915, and 525 in 1919, but increased to 3800 t. in the first nine months of 1920. During the war two new window-glass factories were established in the interior of France—the Société des Verreries Mesmer, at Andrezieux (Loire), and the Société des Verreries du Centre, at Montluçon (Allier). Practically all the factories in the devastated regions have been reconstructed, and the French production of window glass is now much in excess of home requirements. Exporters find it difficult to make firm quotations owing to unstable coal prices and unsettled labour conditions. In December last several factories in the north had to close down owing to lack of orders and dear coal. Large stocks are accumulating, and the Government is being urged to fix a special low price for coal used by glass manufacturers, in order to assist them in competing with their Belgian rivals.—(*U.S. Com. Rep., Jan.* 26, 1921.)

CANADA.

Maple Sugar, Honey, and Wax in Quebec.—The production of maple sugar in Quebec in 1920 amounted to 13,393 long tons, of an estimated value of $7,000,000. Apiculture is also a flourishing industry, and the output of honey and wax was 1313 t. and 12 t., respectively.—(*Official.*)

Mining Developments in Vancouver Island.—The Canadian Pacific Railway Co. is about to undertake a survey of two million acres of mineral-bearing land owned by it in Vancouver Island, the work to be carried out under the direction of the Trail Smelter Co., also owned by the C.P.R. It is considered probable that the survey may lead to the erection of a smelter on Vancouver Island. Particular attention will be given to the development of the coal deposits.— (*Official.*)

Proposed Asbestos Control in Quebec.—The Quebec Government is reported to be considering the question of controlling the asbestos industry of the province in the same way as the pulp-wood industry, *i.e.*, by attaching to mining leases a condition that the mineral won shall be worked up, either wholly or partially, in factories erected in the province. Quebec provides 85 per cent. of the world's supply of asbestos. In 1919–20, 174,521 tons, valued at $11,758,234, was exported; but very little is manufactured in the province.—(*Official.*)

Coal Production in 1920.—The Canadian Bureau of Statistics reports that the output of coal in 1920 was 16,968,568 short tons, the highest production ever attained; in 1919 it was 13,919,096 t. Alberta produced 41 per cent. of the output, Nova Scotia 37·8, British Columbia 18·3, Saskatchewan 1·9, and New Brunswick 1 per cent. By kinds of coal, the increases in output amounted to 0·3 per cent. for anthracite, 16·0 per cent. for bituminous, and 5·6 per cent. for lignite. In December, 1920, 22,848 underground and 8508 surface workers were employed at the mines. Exports increased to 2,558,223 t., compared with 2,070,050 t. in 1919, Nova Scotia being the chief coal-exporting province. Imports from the United States rose from 16,982,773 to 20,815,596 t., Ontario being the largest importer. The total coal supply amounted to 35,225,941 tons.

SOUTH AFRICA.

Output of Base Minerals in 1920.—Returns prepared by the Government Mining Engineer give the output of base minerals in South Africa for 1920 as follows:—

	Output. Tons.	Value. £
Arsenic, white	11	655
Iron ore	2,564	811
Lead ore	587	5,787
Manganese ore	67	277
Zinc ore and concentrates	2,349	15,614
Asbestos	7,112	114,195
Corundum	260	1,446
Graphite	73	2,339
Iron pyrites	3,469	5,014
Magnesite	1,418	3,780
Mica	0.77	500
Ochres, etc.	536	1,049
Talc	682	2,227

The total value of the output was £153,694.—(*S. Afr. J. Ind., Feb.*, 1921.)

AUSTRALIA.

Queensland.

State Enterprises.—The Government of Queensland has undertaken a considerable number of enterprises, under the direction of a Minister for State Industries, which include, among others, pastoral stations, sawmills, coal mines, iron and steel works, canneries, and a produce agency. Last year's balance-sheets for the whole of the enterprises showed assets valued at £1,976,090 and liabilities £1,743,124. The State pastoral stations cover almost 30,728 sq. miles of territory; the coal mines and the steel works are yet in the development stage; and much attention is being given to the development of the cannery industry, which will utilise fruits from the new settlements for returned soldiers formed by the Repatriation Department. The State Forestry Department is also making steady progress, and the director is urging the development of the Forest Products Laboratory. Among the products of the Queensland forests are:—Eucalyptus kinos containing 70 per cent. tannic acid; Cupanias containing commercial saponins; the Bauhinias yield gum arabic; the citron-scented Ti trees produce important essential oils; the Alstonias yield a caoutchouc; the Macrozamias a useful starch and a vegetable wool; and the Grass tree a valuable resin. In addition, there are millions of acres of apparently useless wood which could be distilled for wood spirit, acetic acid, etc.

The Prickly Pear.—This terrible pest is spreading very rapidly over large districts in Queensland, and so far no satisfactory means of eradicating it has been evolved. The following are some of the methods which have been tried experimentally:—(1) The insect *Dactylopius tomtentosus* will under certain circumstances attack the pear and destroy it, but quantities of the insects sufficient for large-scale work have not been obtained. (2) Felling the trees by cheap indentured labour. (3) When properly applied, arsenious chloride gas kills the tree completely, but it is difficult to prevent it rising too quickly. (4) Applying the sun's heat by means of powerful lenses. This method has been tried in California but it is expensive. (5) Submersion under water for three weeks is quite effective. It has been proposed to dam certain rivers, flood the districts for a time, and to use the water afterwards for irrigation purposes. (6) The Director of Forests proposes to master the growth of prickly pear by means of an overgrowth of drought-resisting, umbrageous, leaf-littering trees such as the southern silky oak, camphor laurel, and Canary Island or other pines (*cf.* J., 1919, 455 R).

UNITED STATES.

Vitreous Enamelling.—A valuable bibliography on the vitreous enamelling of iron and steel has been prepared by Dr. C. J. West and printed in the *Journal* of the American Ceramic Society. As the previous list, by J. C. Branner, covered the literature up to 1906, the present one begins with the year 1907.

Visit of Madame Curie.—Madame Curie is about to visit America, and it is proposed by certain women's organisations to present her with one gram of radium, estimated to cost $100,000. Although Madame Curie played a leading part in the discovery of this element, she does not possess any of it to-day, and the object of the gift is to enable her to continue her researches.

Food Research Institute.—A food research institute is to be established at Stanford University, California, by the Carnegie Corporation of New York. Dr. C. L. Alsberg, chief of the Bureau of Chemistry of the United States Department of Agriculture, has been appointed director, and the Corporation will provide $700,000 for the support of the Institute for 10 years. Work will be started on July 1. The University laboratories will be utilised, and duplication of any other work in the field of nutrition will be avoided.

GENERAL.

"Antimony 1913—1919," issued by the Imperial Mineral Resources Bureau as a 34-page pamphlet, describes the chief antimony minerals and their occurrence within the British Empire and in foreign countries, and gives such statistics of production as are available. Antimony is chiefly used in the manufacture of alloys and except in times of war, when large quantities of shrapnel bullets containing about 12 per cent. are required, there does not appear to be a greatly increasing demand. Of the compounds, the tetroxide is used in the ceramic industry for making opaque white enamel, the trioxide (known as antimony white) is used as a pigment, whilst other pigments are antimony vermilion (a red trisulphide of antimony), antimony yellow, produced by the slow oxidation of the sulphide, and antimony blue, resulting from admixture of the above with other minerals. Antimony sulphide is used extensively in the manufacture of rubber goods.

The chief antimony-producing countries in order of importance are China, France, Mexico, Italy, and Australia, but China has long since predominated, and during the war the output of crude regulus and refined antimony greatly increased—from about 13,000 tons in 1913 to about 35,000 tons in 1917. A considerable proportion of the world's output of refined antimony is produced in England from imported raw material. Its high quality is recognised throughout the world.

National Association of Industrial Chemists.—The report of the General Secretary presented at the fourth annual meeting held at Sheffield, Mr. A. B. Searle presiding, states that the Association has successfully come through the recent very critical period caused by industrial depression, and that it now possesses nearly 1100 members. Owing to the need for economy, it has been decided to postpone the publication of a magazine. Members have taken full advantage of the Advice Bureau; a special committee was appointed early last year to draw up a scale of minimum salaries, and as a result of assistance given by the Association over one hundred members who were receiving less than the adopted minimum succeeded in obtaining increases in salary. Another committee was formed to discuss preliminaries with the British Association of Chemists with a view to amalgamation, and negotiations are still proceeding. It is held to be essential to the interests of all British industrial chemists that a single, strong, fully representative organisation should be formed. The Employment Bureau has assisted members in obtaining situations, and only nine are now out of work.

Output of Iron and Steel in the United Kingdom in 1920.—The output of pig iron in 1920 was 8,000,700 tons, an amount which, though 8 per cent. more than the 1919 output—7,398,000 t.—is less than that of any war year and over 20 per cent. less than in 1913. A total of 9,055,600 t. of steel ingots and castings was produced, compared with 7,894,000 t. in the previous year. Production in both cases would have been considerably higher but for the coal strike, which reduced the monthly average during the last quarter of the year. In 1913, a record year, the production of pig iron and steel was 10,260,000 and 7,663,900 t., respectively, and the present proportions of the output indicate that the steel capacity is far in excess of the pig-iron production. The output of metallurgical coke in 1920 was 12,494,400 t., or 1,000,000 t. more than in 1919.—(*Iron and Coal Tr. Rev., Jan.* 7, 14, *Mar.* 25, 1921.)

The Austrian Cement Industry.—The output of the Austrian cement industry for 1920 is estimated at 120,000 to 130,000 tons. Owing to more plentiful supplies of fuel, the production has been increased by 27 per cent., but it is still far below the capacity of the industry and supplies only about 22 per cent. of the normal consumption.—(*U.S. Com. Rep., Jan.* 20, 1921.)

The German Cement Industry.—Government operation of the German cement industry was provisionally abolished in July, 1920, owing to the pressing demand for cement having been satisfied, but the Government still fixes prices for the domestic market. The price of cement increased from 35 to 333 marks per metric ton between August, 1914, and August, 1920, and in December, 1920, it was fixed at 310—333 mk., according to district, lower prices being fixed for cement supplied on Government contracts. During the middle of 1920 cement production increased, partly owing to the resumption of operations of the Offenbach Portland cement works, after a stoppage of over five years. Shortage of coal has affected the cement industry less than other industries, as it has been able to use much low-grade coal. Export of cement has been resumed.—(*U.S. Com. Rep., Mar.* 10, 1921.)

The Mineral Colour Industry in Spain.—A good grade of white lead has been manufactured for many years by the Real Cia. Asturiana de Minas, of Barcelona, a company which owns several large works and can supply most of the Spanish requirements. A small amount of good white lead is also made by the Vincente Fité y Cia at Mataró. Lithopone is made in large quantities principally by the Industriae Quimicas Albinana Argemi company, of Barcelona, which produces a very fine product. The prices of white lead and lithopone are fixed by the Spanish firms so that they are always somewhat lower than those of the imported products. Blanc fixe is made by a number of small firms: the firm of M. and G. Forst, of Barcelona, produces it as a by-product in the manufacture of hydrogen peroxide. As the blanc fixe made in Spain is not of the best quality, the paper factories import it from England, France, and Germany. Chrome yellow of various shades is made in a large number of small works which also produce chrome green by blending the yellow with imported Prussian blue. Chrome yellow, zinc white, zinc yellow, zinc green, etc., are made at Barcelona by the Fabricacion General Espanola de Colores, Gorardo Collardin; red lead and litharge are made in large quantities and at competitive prices by the Real Cia. Asturiana de Minas, the Vicente Fité y Cia., and by a few other small firms in Catalonia.—(*Z. angew. Chem., Feb.* 4, 1921.)

The Swiss Dye Industry in 1920.—Large quantities of dyes and intermediates were exported from Switzerland during the early part of the year and the manufacture of intermediates not hitherto made proved to be very profitable. The high value of Swiss currency, however, hindered trade with certain countries and made it impossible with others. Nevertheless the situation remained satisfactory until the autumn, when the crisis in the textile industry led to a reduced consumption of dyes; by the end of the year the stagnation had become general. The labour situation was good and there were no strikes for increased pay; wages, however, were raised twice during the year. In gauging the future of this industry, it must be remembered that wages are many times greater than those paid in competing countries, and that coal is many times dearer. In view of the contingencies that foreign import duties may be raised, or that economic conditions in Switzerland may affect the export trade, the controlling dye interests in Basle have purchased a factory in the United States at Cincinnati, in addition to the works acquired in England in 1919.—(*Z. angew. Chem., Feb.* 18, 1921.)

Coquito Nuts in Mexico.—The coquito palm grows abundantly in Mexico in the States of Colima, Jalisco, Nayarit, and Sinaloa, where about 5000 tons of nuts are annually harvested. The oil expressed from the nuts is highly prized by the soap manufacturers of Guadalajaia and Mexico, who consume the entire production. Ten years ago when the value of the nuts was little appreciated, they were sold at about $40 per ton, but to-day they fetch $150—250.—(*U.S. Com. Rep., Feb.* 5, 1921.)

Alcohol Production in the Dutch East Indies.—The export of alcohol from the Dutch East Indies in 1919 amounted to 3,397,680 galls., and in the first half of 1920 to 1,827,100 galls., which compares with 2,685,980 galls. in the corresponding period of 1919. The advance in the trade, which is rapidly assuming greater importance, was mainly due to increased exports to Italy and France, and to a very large demand from Singapore, Hongkong, India, and Ceylon.—(*U.S. Com. Rep., Jan.* 19, 1921.)

Cultivation of the Oil Palm in the Dutch East Indies.—Of late years an increasing interest has been taken in the cultivation of the oil palm (*Elæis Guineensis*) in Dutch East India. Throughout the cultivated area of the east coast of Sumatra considerable tracts of land have been planted with this tree, and in 1919 existing estates were extended and new ones opened. At the end of that year 42 estates, covering an area of 13,500 acres, were devoted exclusively to this particular palm, and the total production of palm oil amounted to 830 metric tons, as against 330 tons in 1918. It is expected that during the next few years the area under cultivation will be considerably extended, and if the planting schemes now in hand are fully realised, the cultivated area should eventually yield a production of about 100,000 tons of palm oil.—(*Dutch East Indian Archipelago, Jan.* 25, 1921.)

PERSONALIA.

Prof. L. J. Henderson has been appointed Harvard exchange professor in biological chemistry to France, and will lecture at the Sorbonne during the second half of the present academic year.

Recent appointments in the University of New York include those of Prof. H. R. Moody as professor of chemical engineering, and Prof. W. L. Prager as ordinary professor in the same faculty.

Mr. H. Salt, late of Leeds University, and now of the Forest Products Laboratory of Western Australia, is making a survey of the resources of tanning materials in that State on behalf of the local Government.

Dr. R. F. Ruttan, head of the chemistry department at McGill University, has succeeded Dr. D. G. MacCullum as administrative chairman of the Advisory Council for Scientific and Industrial Research in Canada.

Prof. K. Hess has accepted the post of director of the organic-chemistry section of the Kaiser Wilhelm Institute for Chemistry in Berlin, in succession to Prof. E. Beckman.

Prof. Pietro Corbetta, formerly professor of inorganic chemistry at the Milan Polytechnic, has died in his 72nd year.

The deaths of the following members of the Society in the United States have recently been announced:—Mr. J. Hasslacher, president of the Roessler-Hasslacher Chemical Co.; Mr. J. D. Pennock, general manager of the Solvay Process Co., Syracuse, N.Y.; and Dr. E. J. Lederle, a well-known chemist and bacteriologist.

CORRESPONDENCE.

THE ORIGIN OF THE SOCIETY OF CHEMICAL INDUSTRY.

Sir,—Mr. Douglas Herman, in his letter to the *Journal* of January 31 last, states that the chairman of the meeting held at Widnes at which members of the Faraday Club attended was Mr. James Muspratt, brother of Dr. E. K. Muspratt. Dr. E. K. Muspratt's brother was Dr. James Sheridan Muspratt. Mr. James Muspratt, chairman, would be Mr. James Liebig Muspratt, Dr. E. K. Muspratt's nephew, and son of Mr. Richard Muspratt, of Flint, N. Wales.—I am, Sir, etc.,

St. Albans, Martin Taylor.
March 22, 1921.

Sir,—The letter of Mr. John Hargreaves in the *Journal* for March 15 (p. 86 R) appears on the whole to confirm my own impressions, which were written mostly from memory. The only point at issue between us appears to be the relative influence upon the formation of the Society exercised by the members of the Faraday Club and by the Widnes chemists who wished to name the new society "The South Lancashire Chemical Society"; whereas I believe that the former were mainly responsible, Mr. Hargreaves gives his vote in favour of the latter. Can we not agree to admit that the credit is due to both?

Among the men who assisted notably in the formation of the Society of Chemical Industry I certainly ought to have mentioned the late Dr. Ludwig Mond.—I am, Sir, etc.,

Lyons, Douglas de L. Herman.
March 28, 1921.

PARLIAMENTARY NEWS.

Safeguarding of Industries.

A White Paper (Cmd. 1219) has been issued which sets out the proposed Ways and Means Resolutions to be discussed in the House of Commons prior to the introduction of the projected Bill dealing with "key" industries, etc.

Resolution I proposes the imposition for a period of five years of an import duty of 33⅓ per cent. *ad valorem* on certain articles which include *inter alia:*—(a) Optical glass and optical elements, microscopes, spectroscopes, and other optical instruments. (b) Beakers, flasks, etc. and other scientific glassware and lamp-blown ware, evaporating dishes, crucibles, combustion boats, and other laboratory porcelain. (c) Scientific instruments such as balances, pyrometers, barometers, etc. (d) Wireless valves and similar rectifiers, and vacuum tubes. (c) Ignition magnetos and permanent magnets. (f) Arc-lamp carbons. (h) Metallic tungsten, ferro-tungsten and manufactured products of metallic tungsten and compounds (not including ores or minerals) of thorium, cerium and other rare-earth metals. (i) All synthetic organic chemicals (other than synthetic organic dyestuffs, colours and colouring matters imported for use as such, and organic intermediate products imported for their manufacture), analytical reagents, all other fine chemicals, and chemicals manfactured by fermentation processes. Articles falling under any of the above descriptions which may be contained in any list issued by the Board of Trade are also included.

Resolution II prescribes an *ad valorem* duty of 33⅓ per cent. on "articles of any class or description in respect of which an Order by the Board of Trade has been made under any Act of the present Session for giving effect to this Resolution, if manufactured in whole or in part in any of the countries specified in the Order, or deemed to be so manufactured." The grounds on which such Order may be made are that the article in question is being sold or offered for sale in the United Kingdom (a) at prices below the cost of production, or (b) at prices which, owing to depreciation of the currency of the producing country, are below the prices at which similar goods can be profitably manufactured in the United Kingdom; and that by reason thereof employment in any home industry is being, or is likely to be, seriously affected. The term "cost of production" is defined.

HOUSE OF COMMONS.

Imports of Gas Mantles.

Sir P. Lloyd-Greame, replying to Lieut.-Col. Sir J. Norton-Griffiths, said that 12,668 gross of incandescent gas mantles had been imported from Germany during the period January 1 to March 31, 1921. The general condition of the gas-mantle industry had been considered, and its difficulties were known.—(Apr. 4.)

The Coal Crisis.

In moving a resolution under the Emergency Powers Act, 1920, Sir R. Horne made a statement upon the coal crisis, in which he said that, following on the last coal strike, it was agreed that the owners and the Miners' Federation should attempt to find a new basis for the payment of wages, but the owners desired that any wage basis should be settled district by district, whereas the miners contended that it should be a national settlement, although that involved a pooling system under which profitable undertakings would have to subsidise unprofitable ones. After the determination of decontrol was announced the owners gave notice that they could no longer continue on the same basis and were obliged to fix a new scale. So far the miners had refused to discuss the new rates with the owners, and this had led to the present stoppage. Apparently the issue was not one of wages, but whether there should be a subsidy or not.

Mr. Clynes claimed that the hurried determination of the decontrol of coal was the cause of the trouble, together with the magnitude and suddenness of the reductions in the rate of pay.

Mr. Lloyd George said that the Government would willingly assist in further conference, but it must be understood that there could be no maintenance of the coal industry out of taxation, no re-establishment of control, and that attempts must be made to stop the flooding of the mines.—(Apr. 5.)

The Paper-making Industry.

Sir W. Seager asked if the President of the Board of Trade was aware that out of 48,000 employees in British paper mills 26,201 were totally unemployed and 16,153 on part time, owing mainly to the dumping of paper from Finland, Germany, Sweden, and Norway.

In a written answer, Sir P. Lloyd-Greame stated that he was aware of the unemployment in the industry, and although this was probably accentuated by cheap imports from the countries named, it should be noted that Swedish currency had not depreciated compared with sterling, and that Norwegian currency had depreciated relatively little.—(Apr. 7.)

REPORT.

General Report on the Industries and Commerce of Spain (December, 1920.) *By* Capt. U. de B. Charles, *Commercial Secretary to H.M. Embassy, Madrid. Department of Overseas Trade. Pp. 72. London: H.M. Stationery Office.* 1921. *Price* 1*s*. 6*d*. *net.*

Spain is above all an agricultural country and produces, in addition to fruit and cereals, sugar, olive oil, and esparto grass. Both beet and sugar-cane are cultivated, but the former is the more important, as it is grown over nearly the whole country; cane would be grown much more extensively were larger supplies of basic slag available from England. The sugar industry is controlled by a trust. Spain is the largest producer of olive oil in the world; nearly 4 million acres are planted with the olive tree. The most productive regions are the provinces of Jaen, Cordova, and Seville, and the oil is extracted chiefly in Malaga and Cordova. The estimated production of oil in 1919 and 1920 was 3,360,000 and 2,632,500 quintals, respectively. Not more than 25 per cent. of the production can be classed as fine-grade oil. Export of the oil was prohibited in October, 1920, in order to conserve domestic supplies. Esparto grass grows wild in the mountainous districts near Aguilas and Almeria, and about 150,000 tons is harvested each year. It is chiefly used in the manufacture of paper and rope, but experiments are being made to produce a finer fibre, and one recently obtained compares favourably with the jute yarns used in the manufacture of sacking and fine twines. Export of this grass has fallen off during the last year, but the industry could be much expanded.

The mineral resources are very great, and large areas have not yet been surveyed. In 1918 the capital employed in mining enterprises was estimated at 984,821,000 pesetas, of which 569,630,000 pesetas was held by foreigners (peseta = 9½d. at par). The value of the Spanish mineral production has risen by nearly 75 per cent. during the last seven years, but the output, except that of coal, has decreased owing to industrial troubles, high working costs, and transport difficulties. Iron ore constitutes one of Spain's greatest economic reserves; the provinces of Viscaya, Santander, Almeria, and Huelva are the chief producers. The output of the province of Huelva is mainly iron pyrites. The highest-grade hæmatite ores are gradually being worked out, and it may soon be necessary to exploit deposits more distant from the coast. At present the industry centres round Bilbao, Santander, and Huelva, the output of pig-iron and steel is increasing, and there are now over 30 blast furnaces. The output of steel is almost entirely controlled by a combination of five manufacturing firms, called the Central Siderurgica.

The principal coalfields are situated in Asturias, Penarroya in Central Spain, and the Ebro district, the yearly production being now about 6 million tons. Much interest is being taken in the development of the coal deposits, but lack of experienced miners and modern plant has impeded progress. It is to be hoped that Great Britain will soon regain her former position as an exporter of coal, as the Spanish market is in danger of being lost to the United States. The lead and silver lead mines are mainly situated in the provinces of Cordova, Jaen, Murcia, and Badajoz, and practically the whole output of copper ore comes from the province of Huelva, where the British-owned Rio Tinto and Tharsis mines are the largest producers. Large reserves of zinc ore are stated to exist in the provinces of Santander and Murcia. Almost the whole of the manganese ore produced came from the province of Huelva, where it is found as a silicate with 28—32 per cent. manganese; the output has increased greatly owing to the cutting off of Russian supplies. The production of ores, minerals, metals, etc., in 1919 was as follows:—

	Tons.		Tons.
Coal and lignite	6,243,509	Zinc ores	103,608
Coke, etc.	1,027,936	Zinc metal	16,313
Lead and silver-lead ores	178,055	Mercury ores	24,966
Iron ores	5,071,249	Mercury metal	1,226
Iron and steel	835,356	Manganese ores	66,685
Copper ores	1,470,090	Superphosphates	135,526
Copper metal	34,369	Cement	363,450

The total value of the production at the mines was 499,662,644 pesetas, and the value of the metals etc. at the works was 566,428,928 pesetas. Other minerals found in Spain are potash (the deposits at Cuna, in Barcelona, are said to contain nearly a million tons), salt, phosphates, wolfram, tin, bauxite, ochres, graphite, sulphate of soda, tripoli, and immense quantities of marble, granite, and other building materials.

The development of Spanish industry was greatly stimulated by the war; the machinery, metal, chemical, and textile industries made the most progress, but with the return of peace this advance has not been maintained. With few exceptions, Spanish goods are still far behind the standard of imported goods, and trade is being lost by the short-sighted policy of maintaining fictitious prices.

Although labour is plentiful, the political situation, the shorter working day, and decreased output are seriously affecting trade. The reaction began in 1919, and by the end of 1920 the country was filled with alarm. The total exports in 1919 were valued at 1,316,275,000 pesetas (£52,651,000 at par); about one-half consisted of foodstuffs, and one-sixth of raw materials. The export figures for the first nine months of 1920 are about one-fifth lower than those for the corresponding period in 1919, but mineral exports exceed those of 1919 by about 50 per cent., and chemicals show a gain of 7 per cent. The value of the imports has rapidly increased during the last two years, the aggregate value during January—October, 1920, exceeding those of the corresponding periods in 1919 and 1918 by 32 and 130 per cent. respectively. Imports of chemicals and fertilisers increased by 60 per cent. over those in 1919; 65,500 t. of nitrate was imported from Chile and England, and other fertilisers came mainly from the United States. The United Kingdom was the chief source of mineral colours, varnishes, and writing ink, whereas printing ink and coal-tar colours came largely from the United States. The United Kingdom also supplied practically all the tinplate, a large proportion of the imports of iron and steel, and most of the pharmaceutical products. U.K. manufacturers have a good prospect of recapturing the trade in heavy chemicals, now in Dutch and Belgian hands. British goods are preferred, and the future of British trade in Spain should be assured if local requirements are studied sufficiently.

TRADE NOTES.

BRITISH.

Seychelles in 1919.—The export of copra in 1919, 4328 tons valued at Rs.1,445,722, was considerably greater than in previous years. The cultivation of the coconut has been improved, attention has been paid to its diseases, and experiments have been made on the use as fertilisers of seaweed, ash from the distillation of essential oils, and guano. Nineteen times more rubber was exported than in 1918, the 1919 crop being 27,260 lb. Para rubber grows well, if slowly, but the tapping is badly done. Essential oils are important products, and in 1919, 44 factories produced 24,430 litres of cinnamon-leaf oil, which fetched high prices on the London market. *Ocimum viride* oil, produced experimentally, was found to contain over 50 per cent. of thymol and the cultivation of the plant has been taken up. Ambrette seeds are no longer grown, as they are produced more cheaply elsewhere. Fibre from *Fourcroya gigantea* is made in increasing quantities, and the plant, like sisal, could be grown on a large scale. The exports from the colony were valued at Rs.2,101,377, the chief destinations being France (Rs.1,113,787) and the United Kingdom (Rs.705,422). Imports were valued at Rs.1,125,316, those from the United Kingdom showing an increase of Rs.53,795 compared with 1918.—(*Col. Rep.—Ann., No.* 1061, *Feb.*, 1921.)

FOREIGN.

Proposed Japanese Duties on Soda Products.—According to *The Times*, the Japanese Government has introduced a Bill to increase the import duty on caustic soda by 100 per cent., and that on soda ash and natural soda by 400 per cent. Such increased duties would affect the Japanese glass industry, which exports glass to the value of £1,500,000 yearly, and also British manufacturers of soda compounds

Soda Trade in Manchuria.—There is a considerable demand for soda ash, bleaching soda and caustic soda in the Mukden district; Great Britain and its colonies supply all three of these, Japan only the first two, and the United States practically none. According to the customs returns, 54,286 tons of soda compounds was imported into China during 1919, of which 6316 t. was disposed of in Manchuria. The British Empire supplied 74·5 per cent. of the total Chinese imports, Japan 14 per cent., and the United States 11 per cent.—(*U.S. Com. Rep., Jan.* 14, 1921.)

Japanese Tanning Industry.—This industry developed considerably during the war, and large quantities are now used of galls, oak bark, mangrove bark, quebracho wood and various extracts, principally catechu and persimmon. The persimmon extract is made from a tree grown for the purpose, and an exportable surplus is produced. Imports of tanning materials and tanning extracts in 1919 amounted to 24,876 and 7281 short tons, respectively; they were derived mainly from South Africa)57%), British India (29%) and China (10%); and the sources of the imported extracts were:—Dutch East Indies (34%), Argentina (22%), and the Straits Settlements (21%).—(*U.S. Com. Rep., Jan.* 22, 1921.)

State of Japanese Trade in January, 1921.—The state of the Japanese export trade was still unfavourable in January, and there was little prospect of improvement; imports were also small, and are considered certain to exceed exports for a time. The general financial position, however, was much better than was anticipated at the end of 1920. Stocks of copper amounted to 30,000 tons and were increasing. Reductions had been made in the prices of all products of the Government iron foundry at Yawata, but as the quotations were above market level, consumption can scarcely be affected; stocks in hand at the foundry amounted to 370,000 tons. Such large stocks of European paper had accumulated that manufacturers have reduced production as far as possible, and a fall in prices was anticipated. The depression in the match industry was most severe; many of the smaller manufacturers have suspended operations; all the large companies have made losses, exports have declined by 75·6 per cent., as China, formerly a large customer, is developing an industry of its own, and Swedish competition is growing. Belgium was competing strongly in the glass trade and exporting large quantities of window glass; local prices have been reduced but the decline in export was leading to a diminished output. German reparation dyes were still arriving, but the demand was negligible and stocks were estimated at 290 long tons (aniline dyes 197 t., alizarin 18 t., and synthetic indigo 78 t.).—(*U.S. Com. Rep., Mar.* 10, 1921.)

Siamese Imports of Chemicals and Drugs.—Chemicals and drugs are not manufactured in Siam, and it appears likely that increasing quantities of these materials will be imported in the near future. The imports of chemicals in recent years (the Siamese fiscal year ends on March 31) have been:—1917–18, 949·8 metric tons (£32,245); 1918–19, 1088·4 t. (£52,039); 1919–20, 916·4 t. (£42,995); whilst imports of drugs were:—1917–18, 903·8 t. (£98,910); 1918–19, 980·6 (£137,528); 1919–20, 971 t. (£424,319). The values given assume normal rates of exchange. Hitherto the bulk of the Siamese trade in chemicals and drugs has been in European hands, but the proportions supplied by the United States increased from 1·7 to 4·1 per cent. of the chemicals in 1918–19 and 1919–20, and from 0·7 to 3·5 per cent. of the drugs imported during the same period.—(*U.S. Com. Rep., Feb.* 7, 1921.)

Chinese Trade in Rubber Goods.—Practically no rubber goods are manufactured in China, and the imports of crude rubber and guttapercha are extremely small; in 1919, a record year, they were only 40 tons. The market for tyres, though limited to the few districts with good roads, is steadily developing and the value of the net import of motor-car tyres into the Shanghai district is ten times greater than in 1913. Tyres and other rubber goods rapidly deteriorate on keeping, and therefore big stocks cannot be held. There is an excellent demand for rubber goods such as gloves, hot-water bottles, vulcanite, etc., but the market for rubber foot-wear and clothing is small, although proofed fabrics apparently sell more readily. The chief port of entry for rubber and rubber manufactures is Shanghai, followed by Dairen, and the import duty is 5 per cent. *ad valorem,* plus 5 per cent. of the duty charges for wharfage and warehouse dues. —(*U.S. Com. Rep., Jan.* 19, 1921.)

COMPANY NEWS.

BRITISH DYESTUFFS CORPORATION, LTD.

The second ordinary general meeting was held on April 1, in Manchester. Sir H. Birchenough, who presided, referred to the late Lord Moulton's services to the dye industry, and then commented upon the report and accounts. In spite of the fact that only a part of the capital had been remuneratively employed, the year ended October 31 last was a satisfactory one. The profit, after allowing for depreciation and taxation, was £552,100 (issued capital £9,202,093), out of which the full 7 per cent. dividend on the preference shares had been paid; a dividend of 8 per cent. on the preferred ordinary shares was recommended, leaving £203,304 to be carried forward, as against £58,826 brought in. The sum of £289,366, inclusive of capital expenditure, had been spent on research during the past two years, and preliminary expenses figured among the assets at £251,551. On October 31 stocks in hand were valued (at cost or market price) at £3,998,543. The sum of £593,486 had been set aside to cover depreciation during the past two years, and in view of present trade conditions the directors had decided to suspend expenditure on constructional work.

The policy of the Corporation was to establish and develop a dyestuff industry which would gradually supply all the requirements of British consumers, and that progress in this direction had been made was evidenced by the fact that the increase in output was 54 per cent. above that for the previous year. Trade was so active during the early part of the year that all the demands of the colour-users could not be met, although sufficient dyes were supplied to enable them to take advantage of that period of unexampled prosperity. As the year 1920 advanced conditions became gradually worse owing to the flood of German imports and the general decline in trade. Every effort had been made to develop the Research Department under the direction of Prof. A. G. Green and Dr. R. Robinson, but the system of dual control by two managing directors had proved unsuccessful; it had been decided to replace the latter at an early date by one individual, but in the meantime the executive powers of the board would be vested in the chairman and two of the new directors, Sir W. Alexander and Mr. Vernon Clay, chairman of the Colour Users' Association (the third new director being Field-Marshal Sir W. Robertson). The late managing directors had been appointed ordinary members of the board, and the immediate duty of the new executive committee was to organise adequately the staff of the Corporation.

On questions being invited, Mr. J. Parker Smith moved that the adoption of the report should be deferred pending the report of a committee of investigation, but that the accounts be approved and the dividend on the preferred ordinary share be paid. He criticised very adversely the supersession of the two managing directors, Sir J. Turner and Dr. H. Levinstein, who had been the mainstay of the dye-making industry in this country. After a succession of speakers had spoken in favour of the amendment and several had demanded the reason of the summary action taken against the two managing directors, the chairman said that the board could not agree to the course proposed, and that he was not prepared to argue the matter at a general meeting. The decision had been made after deliberate consideration; it was well known that the managing directors had not co-operated harmoniously, and the interests of the Corporation demanded the termination of their contracts. On a show of hands the amendment was declared lost by a narrow majority, and another amendment—that the appointment of the new directors be not confirmed—was rejected on a poll.

Borax Consolidated, Ltd.—The Rt. Hon. the Earl of Chichester, in presiding at the general meeting of this company held on March 21, said that the net profits for 1920 amounted to £476,581, compared with £442,023 in the previous year. The total of the reserve funds was £827,179 (issued capital £4,494,978, inclusive of debentures). A very large amount of ore was in sight, stocks stood at £506,617 on September 30, and the sum of £664,415 was on deposit and current accounts. A Continental works had recently been purchased on favourable terms, and other developments were contemplated. There were signs of recovery from the present bad trading conditions. Dividends on the deferred ordinary shares amount to 15 per cent. for the year.

British Aluminium Co., Ltd.—Addressing the annual meeting on March 31, Mr. A. W. Tait, chairman, stated that the company had achieved a record output and record sales during the year 1920; the great demand during the early part of the year could not be fully met. The company took over the entire Government stock of aluminium, all of which had now been disposed of. The period of financial stringency, which began last August, led to a serious disturbance of the motor trade and of the aluminium industry. Adverse conditions still prevailed, although there were signs of improvement; meanwhile the company was restricting its output. A great future awaited the application of suitable aluminium alloys in the motor trade and in general engineering, in the electrical industry, and in the manufacture of domestic utensils. Additions had been made to the alumina works in Scotland, and to the rolling mills at Warrington. The company had again taken steps to acquire additional water power in Scotland, and had modified the scheme put forward in 1918, which did not obtain Parliamentary sanction, in such a way as to allay local opposition. The new Bill had passed its second reading in the House of Commons. Some further work had been done on the company's power scheme at Orsières in Switzerland, but operations had since been suspended pending more favourable times. The profits for the year were £348,108 (issued capital, with debentures, £2,637,189), and the directors recommended a dividend on the ordinary shares bringing the total dividend upon them for the year up to 10 per cent. The liquid resources of the company were satisfactory.

New Issues.—Lever Bros., Ltd. has made an issue of £4,000,000 seven per cent. first mortgage debenture stock at 92½ per cent., redeemable at par in 1941, or in 1931 at the option of the company. The authorised share capital of this company is £130,000,000, of which £46,996,499 has been issued; assets at December 31 last were valued at £50,734,770. The Mond Nickel Co., Ltd. has offered £1,300,000 of 8 per cent. mortgage debenture stock at 98, redeemable in 1941 at 104 per cent. The issue was quickly subscribed. An issue by the British Oxygen Co., Ltd. of £250,000 of 8 per cent. first mortgage debenture stock at 96 per cent. was also rapidly taken up.

OFFICIAL TRADE INTELLIGENCE.

(From the Board of Trade Journal for March 24, 31, April 7.)

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W. 1, from firms, agents or individuals who desire to represent U.K. manufacturers or exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department and quoting the specific reference number.

Locality of Firm or Agent.	Materials.	Reference Number.
Australia	Crockery, imitation leather	362
British West Indies	Glassware	426
Canada	Artificial silk yarns	393
..	Crockery, glass, scientific instruments, chemical plant, sugar machinery (catalogues of)	*
..	Drugs	‡
..	Creosote	—
Cyprus	Fertilisers, soda crystals	427
New Zealand	China, glassware	398
Belgium	Pitch	372
Bulgaria	Creosote, zinc chloride	—
France	Asbestos materials, vulcanised fibre, emery cloth	402
Italy	Leather	403
..	Soap and paper-making materials, oils and starches	433
..	Oils and fats	434
Norway	Spring and tyre steel	378
..	Steel rails	379
..	Iron and steel sheets and pipes, steel wire	405
..	Pig iron, steel plates	436
Serbia	Creosote	—
Spain	Chemicals, drugs, paints	380
..	Iron and steel hoops	408
Sweden	Cocoa, sugar, syrup	382
..	Chemicals for textiles	383
..	Salt	438
Switzerland	Industrial porcelain, china clay, non-ferrous metals	439
Algeria	Chemical products, leather	441
China and Japan	Iron, steel	385
Eastern Siberia, Manchuria	Pottery, glassware, belting	386
United States	Rubber goods	442
Mexico	Chemicals	452
Mexico and Cuba	Pottery, soap	451
Panama	Drugs	453
Argentina	Paint, varnish	446
..	Chemicals	447
..	Rubber goods, metal sheets, tubes, etc.	449
Uruguay	Wire, ropes	391

* H.M. Trade Commissioner, 257/260, Confederation Life Buildings, East Queen Street, Toronto, Canada.

‡ High Commissioner for Canada, 19, Victoria Street, London S.W. 1.

TARIFF. CUSTOMS. EXCISE.

Australia.—As from April 1, licences for the import of foreign dyes, whether from stocks in the U.K. or not, are subject to permit issued by the High Commissioner's Office.

Austria.—Import licences are now required for certain leather and leather wares, and export licences for tanning materials, leather and leather wares (with some exceptions).

Belgium.—It is proposed to increase the customs duties on, *inter alia*, photographic apparatus, perfumes, pottery, glassware (except bottles), and mineral waters.

Licences are no longer required for the export of bottles, demijohns, cylinders for compressed and liquefied gases, carbonate of soda, natural cement, undressed hides and skins, superphosphates, linseed, rape-seed, scrap metals, coal-distillation products, and pyrites residues.

The export of bricks, artificial cement, raw bones, and fertilisers (except superphosphates) is subject to licence, but fertilisers, except potash salts, may be exported without licence as from June 1.

Bulgaria.—Export duties have been reduced on certain skins and edible fats.

Federated Malay States.—The export of china clay, felspar, and china stone is prohibited as from January 7.

Fiji.—The complete text of the revised customs tariff schedules may be seen at the Department, 18, Queen Anne's Gate, London, S.W. 1.

Exportation of gold and silver coin and bullion, rice, and raw sugar is prohibited as from December 15, 1920.

France and Algeria.—The export duty on oilcake has been modified.

The restrictions on the import of cellulose pulp and of paper in rolls have been withdrawn.

Greece.—The restrictions on the import of calcium carbide have been removed.

Grenada.—Additional export taxes have been levied on cocoa, cottonseed, nutmegs, and mace.

Italy.—Export licences are no longer required for manganese ore, magnesite bricks, newsprint paper, quinine salts, copper sulphate, and zinc waste.

Lead and zinc ores are again subject to export licence.

Malta.—The metric system of weights and measures will be used in levying customs duty as from July 1. Articles affected include alcohol, alcoholic beverages, malt, edible oils, petroleum, saccharin, sugar, spirit varnish, and vinegar.

Martinique.—The export duty on sugar has been increased to 21 fr. per 100 kg.

Netherlands.—The prohibition on the export of phosphatic fertilisers, glass powder, wood, zinc ore, and zinc oxide has been withdrawn.

The export of 240,000 metric tons of sugar-beet will be permitted, although the export prohibition remains in force.

Import duties have been increased on chloral hydrate, sulphuric and acetic ether, collodion, chloroform, spirit of nitrous ether, and similar substances prepared from or with alcohol.

New Zealand.—The regulations relating to the standards and labelling of vinegar are set out in the issue for April 7.

Nigeria.—Non-proprietary medicinal preparations containing alcohol imported by registered medical practitioners, dentists, and licensed druggists may be exempted from duty by the Governor in Council.

Portugal.—Paper fabrics and earthenware insulators now pay an increased customs duty.

Rumania.—The export duty has been modified on certain petroleum products and on oilcake.

Serb-Croat-Slovene State.—The export of all goods is allowed under conditions laid down in the Decree of April 16, 1920, with some exceptions, among which are sugar, gold, silver, and scrap iron.

Spain.—The export duty on oilcake has been abolished, but the export thereof is still subject to licence.

Switzerland.—Importation of industrial alcohol by private persons is prohibited.

As from March 18, import licences are required for paper, cardboard, and wares thereof, and for glass bottles.

Special export licences are required for, *inter alia*, cocoa powder, condensed milk, waste paper, scrap iron, copper turnings, precious metals, saccharin, potassium permanganate, indigo, and certain coal-tar colours.

Tunis.—Sugar may now be imported freely under certain specified conditions.

GOVERNMENT ORDERS AND NOTICES.

EMERGENCY REGULATIONS, 1921.

An Order in Council, issued on April 4, under the Royal Proclamation of Emergency, makes Regulations which empower the Government to take possession of land, works, plant, food, material, stores, etc., to regulate transport by road, light railway or canal, and requisition vehicles, to close ports and harbours, prohibit exports, control the supply of gas, water, electricity, and motor spirit, and to take possession of all or any coal mines, together with any plant, vehicles, railway wagons, etc., necessary for maintaining the supply and distribution of coal.

Coal Emergency Directions.—The Coal (Emergency) Directions, 1921, issued by the Secretary of Mines provide for a reduction of 50 per cent. in the industrial consumption of coal and fuel derived therefrom, prohibit the shipment of coal either as cargo or bunkers save with the permission of the Secretary for Mines or a person authorised by him, and regulate the supply and distribution of coal. Lighting used for advertisement and display is prohibited, gas and electricity companies are empowered to reduce the supply in order to economise coal, and the use of gas or electricity for power production is restricted by 50 per cent. The Directions came into force on April 2.

Prohibited Exports.—Licences are no longer required for the export to Russia of any goods other than those the export of which is prohibited, except under licence, to all foreign countries.

REVIEWS.

Les Ethers Cellulosiques. *Pt. I.: Les Ethers Minéraux de la Cellulose. Vol. I.: La Nitrocellulose et le Celluloid. By* André Dubosc. *Pp.* 334. (*Paris: A. D. Cillard.* 1920.) *Price* 45 *francs.*

A book bearing this title naturally attracts the attention of celluloid chemists, explosives chemists, and that increasing number of scientists who are investigating the colloidal behaviour of nitrocellulose. It is to be feared that each class will feel some disappointment after reading the book. Celluloid chemists and explosives chemists will find, it is true, a number of full descriptions of plant and processes, but not much that is new, and they will occasionally find that the data relating to the two industries are difficult to disentangle. Colloid chemists, on the other hand, will find little that is of interest, except some generalities on the colloidal constitution of celluloid. Possibly later volumes will be more stimulating in this respect. Some most important researches on nitrocellulose which have a direct bearing on the constitution of celluloid have recently been published, and it is to be hoped that the author will discuss these in due course.

The present volume deals with the manufacture of celluloid as far as the preparation of bleached and washed nitrocellulose pulp. It opens with a historical introduction, in which the author accepts the account of the discovery of celluloid given by Chandler (*cf.* J., 1914, 225) on the occasion of the presentation of the Perkin medal to J. W. Hyatt in 1914. This account led at the time to a somewhat acute discussion (*cf.* J., 1914, 678) on the relative claims of Hyatt and Daniel Spill, in which neither side perhaps did justice to the versatile genius of Alexander Parkes; however, the claims of

Parkes to fame rest also on his researches in electrodeposition and metallurgy, and there is no need to reopen the discussion. The chapter on the physical and chemical properties of celluloid will prove the most interesting to those outside the industry, and here one is impressed with the absence of direct experimental evidence for the theories advanced. The truth is that the experimental difficulties are so great and the complications so many in the case of the concentrated plastic masses obtained in celluloid manufacture that the results obtained from experiments can only be empirical. It is usually impossible to control experiments so that only one factor varies at a time, which is the ideal condition sought for in research. How many chemists would be prepared to assert that any two samples of nitrocellulose were identical? This difficulty arises at the outset, and since the nitrocellulose must be bleached, pulped, washed, dried, blended with solvents, kneaded, rolled, pressed, sliced, and stoved, and since, moreover, a few minutes more or less spent in some of these processes may profoundly modify the properties of the product, it is frequently impossible to ascribe the difference between any two samples of celluloid to a single cause. We are forced to conclude that the systematic study of solid celluloid must start with dilute solutions of nitrocellulose, and, although the author's views on the colloidal phenomena accompanying celluloid manufacture are interesting, we think that, for the present at any rate, they will prove sterile. A more promising system of attack would be to examine Bingham's division of colloid solutions into viscous liquids and highly mobile plastic solids, and to investigate nitrocellulose solutions in varying concentrations from this point of view. Until we know more about the distribution of solvent between the phases in dilute nitrocellulose solutions, we cannot expect to understand much about the constitution of solid celluloid.

The raw materials of celluloid manufacture are treated fully, and the author has made good use of the information contained in papers read before this Society by de Mosenthal (*cf.* J., 1904, 292; 1911, 782). The chapter on nitration is preceded by a theoretical discussion on etherification, which, although not directly applicable to the nitration of cellulose at present, is perhaps a useful caution against too much rule-of-thumb in the control of the factory operation. The somewhat obvious mathematical treatments of nitration and doping due to Clément, which have already been published more than once, are less useful than Fowler's graphical method (*cf.* J., 1919, 34 T), and might have been omitted, as well as some of the ancient formulæ dating back to the infancy of the industry. There is an interesting section on the Thomson displacement process in which the author sums up strongly against its applicability to the manufacture of nitrocellulose intended for celluloid manufacture. The last two chapters deal with stabilisation, washing, pulping, and bleaching, and due emphasis is placed on the necessity for using pure water and for avoiding any process which will injuriously affect the colour of the product. This important distinction between explosives practice and celluloid practice is not always appreciated.

There are no illustrations of plant in the book, which detracts from its usefulness. The type is good and only a few misprints have been encountered, among which "Van T. Hoff" has a quaintly American flavour. It is to be hoped that in the succeeding volumes M. Dubosc will break away still further from the tradition that books on nitrocellulose should be merely abstracts of patents of varying vitality, and will discuss the problems of celluloid manufacture in the light of his own unquestioned experience.

F. SPROXTON.

INDIAN TANSTUFFS. *By* J. A. PILGRIM, *Government of India, Board of Industries and Munitions.* (*Calcutta: Superintendent Government Printing, India,* 1920.) *Price* 6 *annas.*

The Government of India is to be congratulated on the production of a short, concise report of valuable chemical research in which the practical and commercial application of results is not overlooked. Mr. Pilgrim's handbook contains the results up to April, 1920, of his and Mr. W. Fraymouth's examination of the barks, leaves, fruit, etc. of Indian forest species, mainly from the point of view of manufacture of tannin extracts for export. The requirements of the Indian tanner, *i.e.*, cheap tanstuffs to be used in direct contact with the hide, are also not lost sight of. With the exception of one or two species, which are duly noted, many samples of each tanstuff have been examined, and it is evident that the sampling of each bark or leaf has been carried out with great care, thus greatly increasing the value of the conclusions arrived at. Hide-powder estimation of tannin is not an exact analysis, but if used as Mr. Pilgrim evidently uses it, it is of great value in determining the tannin value of barks, etc. We consider the publication of negative results, *e.g.*, those on pages 24 and 25, as of great value. It is not always appreciated that negative results are as valuable as positive results in research work.

Analyses and practical leather-making have established the value of Thawai (*Woodfordia floribunda*) bark, and if this could be produced at a low price in quantities, it is clear that it would threaten the consumption of South African wattle. It is to be regretted that the present bulletin does not contain figures of cost of the tanstuffs as the earlier bulletin did. It would be best to express these in shillings per unit of tannin per ton, free on rail in India. This applies also to a recent report in a trade paper showing extraordinarily favourable figures of tannin and non-tans in certain oak and chestnut barks which have been studied in Northern Burma (presumably by Mr. Pilgrim). Nothing whatever is said of the distance from the rail at which the forests of these trees are found, nor whether labour is available at reasonable prices for collecting the barks. Mr. Pilgrim continues the practice of examining samples of bark from each part of the tree, and we would urge that a full range, from bole, low branches, high branches, twigs, etc., should be studied in every case where the first examination demonstrates the possibility of a valuable source of tannin.

The principle adopted in the earlier researches at Maihar, viz., to collect the tanstuff without destruction of the tree, appears to have been less rigorously followed in the later work recorded in this report. The history of the tanner's bark has always been the same. A cheap and good bark becomes expensive as the demand grows and as the most accessible forests are depleted. It was so with English oak, with hemlock, and now with South African wattle, although in this case the bark exploiters have replanted vigorously. It appears probable that, other conditions being equal, the bark which can be got without destroying the trees will finally hold the market.

In a thoughtful preface Mr. Pilgrim explains his principles in studying Indian tannins from the point of view of extract-making. Unfortunately he adopts the standard of "crystals." It is a fact that all the biggest tanners, in Britain at any rate, if they use solid extract at all, demand a clean-fracture solid which generally contains more moisture than the 5 per cent. carried in "crystals."

The extent and resources of the forests of the Indian Empire are as yet little known in Britain, but now that the Forest Research Institute at Dehra Dun has received bigger grants and has engaged several new scientific officers, it is to be expected that regular reports on the progress of research will appear. It is to be hoped that after the present trade depression is over, British financiers will study the work done and take the earliest opportunity of exploiting new discoveries. During the years before the war a large number of German firms in India had commenced such exploitation. The opportunity presented now by the absence from India of all ex-enemies will not last for ever, and the presence in India of other than British firms should be closely watched, if the spirit of the new reforms, *i.e.*, close co-operation between the Britisher and the Indian, is to be followed.

A TEXT BOOK OF CHEMICAL ENGINEERING. *By* EDWARD HART. *Pp.* 211, *with* 200 *figures.* (*Easton, Pa.: The Chemical Publishing Co.; London: Williams and Norgate.* 1920.) *Price* 4 *dollars.*

There are not many text-books of chemical engineering, and therefore many chemists will welcome the opportunity of reading this small but attractive book, which is printed in good style, with profuse illustrations. The reading matter is, on the whole, very good, but all too brief to be of great service to the chemical engineer. As stated by the author, the book is primarily intended for the use of the college student and purposes to give him a general idea of the type of plant employed for standard operations in the chemical industry. Comparisons of one system with another are seldom attempted; these, though apt to be invidious, are very helpful. Exposition of the theory underlying the design or operation of the plant is also lacking. Historical matter is curtailed to a minimum and old-fashioned, inefficient appliances are omitted. For this reason the book gains in conciseness and can be said to be quite up-to-date as regards the subjects treated.

The chapters on crushing, filtration and drying are specially good, except for the lack of critical comparisons. Probably most industrial chemists would regard the chapters on boilers, prime movers and plumbing as superfluous, though the college student will, no doubt, find them useful.

There appear to be few errors of commission, but, naturally, a good many of omission. We do not find, for example, any information with regard to water, gas and electricity supply, disposal of waste, centrifugal pumps, electrostatic precipitation, furnaces, gas washing, recovery of light spirit, fractional condensation, refrigeration, liquefaction, heat exchange, etc.

Whilst the general quality of the illustrations, which fill more than half the pages, is excellent, a few are distinctly open to criticism. For example, the circular stoneware tower appearing as a full-page illustration on page 63 (and again on page 200!) shows acute and right-angled pipe-bends, which the engineer tries to avoid. Some of the illustrations, for example, figs. 188 and 189, are not accompanied by the necessary descriptive and explanatory text. Fig. 154 is badly drawn.

As a short and handy book for students this work has much to commend it.

W. B. DAVIDSON.

CORRIGENDA.—In the issue for March 31, p. 113 R, under Legal Intelligence, Rail Conveyance Classification of a Washing Powder, substitute "Class C" for "Class 2" in lines 8, 15, and 26; and in lieu of "soap powder" read "washing powder" in lines 11 and 24.

OBITUARY.

LORD MOULTON OF BANK.

By the death on the 9th ultimo of Lord Moulton the Society has lost one of its most brilliant members. From New Kingswood School, Bath, John Fletcher Moulton went to Cambridge (St. John's College), where he became Senior Wrangler and First Smith's Prizeman. He took his M.A. degree of London University, and later that of Cambridge, becoming soon after a Fellow of Christ's College. Resigning his Fellowship in 1873, he was called to the Bar in the following year, taking silk in 1885. As the most successful patent lawyer of his day, he acquired knowledge of the arts of the chemist, the physicist, and the technologist, so that he had understanding of their language and their writings, a possession of special importance in handling the great number of legal cases pertaining to industry, and especially chemical industry, in which he was engaged. He was a member of the House of Commons, a Lord Justice of Appeal, a Lord of Appeal, and a Privy Councillor.

Here, in all probability, this notice would have concluded had it been written before August, 1914.

But war came, and Lord Moulton, then 70 years of age, placed his talents and his energies at the disposal of his country in her hour of trial. He first took up the matter of dye production—German supplies having suddenly ceased, leaving the textile industries faced with the impossibility of finishing their productions—the politicians' cry of "Business as usual" ringing more clearly in the ears of the nation than the danger alarm raised by the few who knew Germany and German aims. But it was quickly realised that the country was confronted with more serious tasks than the dyeing of cottons and silks, and, putting dyes for the time being on one side, Lord Moulton was entrusted with the chairmanship of a small advisory committee on high explosives. At that time the British Government made propellants but no high explosives, except a little tetryl (trinitrophenylmethylnitroamine) at Waltham Abbey. Picric acid, the standard one, was purchased from a limited number of contractors in relatively small quantities. TNT had hardly come upon the scene; its manufacture from toluol had been proposed to the writer some time before the outbreak of war, but in response to his inquiry as to the attitude of the War Office, he was told it was not favoured, although it had been brought into use in Germany. In England it was used only for minor purposes and in very small quantities—practically as a by-product of the dye industry.

The nation's pitiable plight of unpreparedness both in raw material supplies and in large scale processes soon became increasingly apparent. Germany had monopolised the organic chemical industry so completely that the greatest difficulties were experienced in this country when she was suddenly called upon to produce nitro-compounds in large quantities. We were short of plant, of trained chemists, and of manufacturing knowledge. Lord Moulton realised, more than any man, the inadequacy of our resources and the magnitude of our requirements. As chairman of the High Explosives Committee (A.6) under the Director of Artillery, his powers were gradually extended until in February, 1915, he had liberty to utilise to the utmost the capacity of the country. Four months later he became Director-General of the Department of Explosives Supply in the newly formed Ministry of Munitions of War. In order to work out the chemical and technical problems involved in manufacture on the necessary scale, the whole chemical industry throughout the length and breadth of the land was organised and co-ordinated under his direction, no undertaking being too small to be entrusted with a share of the task. The production of the necessary raw materials was similarly dealt with, and before many months passed both crude- and final-product manufacturers were working in friendly consultation and competition, inspired by a most efficient system of costing and yield-checking worked out and put into operation at the headquarters of the department.

The preparation of high explosives was beset with greater difficulties than that of propellants, for besides the Government factory several private firms were well versed in the manufacture of cordite. On the other hand, the resources for picric acid (the standard high explosive) were inadequate not only as regards manufacturing capacity but also as regards raw material. This led to the manufacture of synthetic phenol and the inauguration of the production of TNT. As neither of these substances could be turned out in quantities sufficient to satisfy shell-filling requirements, Lord Moulton urged the addition of ammonium nitrate explosives, such as ammonal, schneiderite, and, later, amatol. Numerous problems of filling, detonation, and exploding were thereby introduced which required close investigation. Ultimately all troubles were overcome and the mixed explosives, in the preparation of which enormous quantities of ammonium nitrate were required, were entirely successful. The difficulties besetting adequate production were increased by the high standard of purity necessary for Service purposes, and the specifications were being constantly revised in order to reconcile quality and quantity. It has already been stated that the manufacture of TNT was practically new in this country, and Lord Moulton played a large part in raising it from small beginnings to a very large scale. This needed the organisation of materials, methods, and plant, with which he kept in close touch and in the development of which he rendered great assistance. Originally slow and wasteful, the processes were ultimately improved until they showed an efficiency upon which it would be difficult to improve. Purification methods were of great importance. These were originally attached to each plant, but one or two accidents led to their removal to separate works. The original process was crystallisation from alcohol, afterwards abandoned for washing in the cold first by alcohol, and later with sulphite. The latter method was introduced by Lord Moulton from France, where he found it in use. Safety precautions was another matter requiring careful watching, and Lord Moulton organised a special "Safety of Factories Branch" for the independent inspection of the many chemical factories. The fixation of nitrogen did not mature during the war. It formed the subject of investigation by a separate body, the Nitrogen Products Committee, of which Lord Moulton was a member. He several times expressed the opinion that one of the chief determining factors which induced Germany to choose August, 1914, as the date for launching the war was the perfecting and extension of the Haber process—without synthetic nitrates she would have lost the war within a year or less. Our own dependence upon imported nitrates was one of the weakest links of our defence, and the destruction of ships carrying them caused great anxiety and at times acute shortage.

In the spring of 1918 Lord Moulton took up the supply of poison gases, and this necessitated the establishment of factories for their production. The work was very distasteful to him, but he prosecuted it with vigour and entered closely into all the chemical and technical problems involved, which were naturally very numerous. The chief products were dichlorodiethylsulphide, phosgene, chloropicrin, and some arsenic compounds.

Lord Moulton was an energetic advocate of the establishment of a British dye industry on a scale large enough and strong enough to stand up against German competition, and he became Government representative and chairman of British Dyestuffs Corporation, Ltd., in 1919, holding the position until the following year, when he returned to his judicial labours.

It is not too much to say that under him the whole chemical industry of the country was not only reorganised on a basis enabling it to fulfil its war-time tasks, but also, and only second in importance, to meet adequately the post-war requirements of the nation. No man was better able to undertake two tasks of such magnitude. He was not merely an able lawyer, but a far-seeing and cultured man of the world and its affairs; and among other qualifications the possession of a large fortune acquired at the Bar must not be overlooked, since it placed him in a position of unassailable security in dealing with Governmental methods and red tape which might have weighed against the success of one less prominently and assuredly circumstanced. His name will be indissolubly connected with the future of chemical industry in Great Britain.

PUBLICATIONS RECEIVED.

Chemical Technology and Analysis of Oils, Fats and Waxes. Vol. I. *By* J. Lewkowitsch. *Edited by* G. H. Warburton. *Sixth edition, entirely rewritten and enlarged. Pp.* 682. (*London: Macmillan and Co., Ltd.* 1921.) *Price* 36*s*.

The Electronic Conception of Valence and the Constitution of Benzene. *By* H. S. Fry. *Monographs on Inorganic and Physical Chemistry, edited by* A. Findlay. *Pp.* 300. (*London: Longmans, Green and Co.* 1921.) *Price* 16*s*.

Modern Chemistry, Pure and Applied. *By* A. J. Hale. *Six Volumes. Vol. I., pp.* 272; *Vol. II., pp.* 276. (*London: Virtue and Co., Ltd.* 1921.) *Price* 16*s. per volume.*

Traité de la Conservation et de l'Amelioration des Bois. *By* M. de Keghel. *Encyclopédie Industrielle. Pp.* 360. (*Paris: J.-B. Baillière et Fils.* 1921.) *Price* 10 *fr., bound* 15 *fr.*

Die Welt der Vernachlaessigten Dimensionen. *By* Wo. Ostwald. *Fifth and sixth editions, revised. Pp.* 253. (*Dresden and Leipzig: Theodor Steinkopff.* 1921.) *Price* 7*s*.

Grundriss der Kolloidchemie. Part I. *By* Wo. Ostwald. *Sixth edition, forming a reprint of the fifth edition. Pp.* 253. (*Dresden and Leipzig: Theodor Steinkopff.* 1921.) *Price* 10*s*.

Kleines Praktikum der Kolloidchemie. *By* Wo. Ostwald, *assisted by* P. Wolski. *Second edition. Pp.* 159. (*Dresden and Leipzig: Theodor Steinkopff.* 1921.) *Price* 4*s*.

Imperial Institute Monographs with Special Reference to the British Empire. (*London: John Murray.* 1920 *and* 1921): —

Coal. *By* J. H. Ronaldson. *Pp.* 166. *Price* 6*s*.

Chromium Ore. *By* W. G. Rumbold. *Pp.* 58. *Price* 3*s*. 6*d*.

Publications of the United States Geological Survey. *Department of the Interior.* (*Washington: Government Printing Office*): —

Magnesite in 1919. *By* C. G. Yale *and* R. W. Stone.

Phosphate Rock in 1919. *By* R. W. Stone.

Sand-Lime Brick in 1919. *By* J. Middleton.

TOWARDS UNITY.

It is encouraging to note that the various proposals relating to the organisation of chemistry in this country which have been put forward from time to time by the Federal Council for Pure and Applied Chemistry have met with a uniformly favourable reception, and that the only criticism heard is that action has been too long delayed. In other words, to use Matthew Arnold's phrase, appreciation has been the soul of criticism, and this circumstance affords a very happy augury of benefits to come.

An important move in the direction of unity was made by the Council of the Society of Chemical Industry at its last meeting, when, in response to a suggestion received from the Council of the Chemical Society, it was resolved unanimously that the existing machinery of our Local Sections should be made available to a certain extent to members of the Chemical Society, the Society of Public Analysts, and, by implication, to members of other chemical organisations. The specific suggestion referred to was that papers on pure chemistry, whether contributed by members of the Society of Chemical Industry or others, should be accepted for reading at the meetings of our Local Sections, and that the Chemical Society should consider for publication any such papers sent on to it by us. The Council of this Society, in approving the suggestion as a council, decided to recommend its adoption to the Local Sections, and to leave details to be settled later.

The advantages to be derived from such a scheme are many. For some time past there has been a congestion of papers presented for reading at the monthly meetings of the Chemical Society, with the result that some of them are not read at all, and others are inadequately discussed. Furthermore, many Fellows are put to considerable inconvenience and expense in travelling to London to read their papers, and by increasing the number of localities where and occasions when papers can be read, delay in presentation and publication will be obviated, and a greater proportion of the contributions will be discussed and criticised. A paper, when read, may give rise to instructive and constructive criticism, valuable alike to author and audience, even if it be not sufficiently important to warrant subsequent publication; and the mere fact of public presentation would ensure, at any rate, a notice of the paper in the chemical scientific press, and perhaps also in the local newspapers.

From the point of view of our Local Sections it would appear that the reading of papers on pure chemistry would add to the attractiveness of meetings by providing a greater variety of subject matter. Those Sections which sometimes experience difficulty in filling their programmes would find relief in the greater quantity of material available, a consideration which applies more particularly to University towns; and other Sections which, owing to favourable environmental or other circumstances, have no such difficulty would reap the advantages of better attendances and wider publicity. In such cases it may be that the time devoted to the reading of each paper on the agenda would have to be curtailed, but many would regard this as an advantage; long papers are apt to become wearisome, and a free, fluent delivery of "things that matter" is preferable to reading verbatim, especially if an abstract has been circulated beforehand. Further, such composite gatherings would afford a common meeting-place for chemists of all classes and descriptions; readers of papers on technical chemistry would have the advantage of criticism by those who cultivate the "pure" science, and *vice versa;* and the opportunities afforded for social intercourse would be generally fruitful of much good, alike from the scientific, technical, and professional points of view.

But above and beyond all is the consideration that the whole-hearted adoption of the proposal would give impetus to the movement for securing that unity in the profession and practice of chemistry which many of us have so much at heart. The advantages accruing from co-operation and coordination have been dinned into our ears in recent years almost *ad nauseam*, and the time is surely ripe for action. Although the realisation of certain other proposals, such as that for a central Chemical House, may have to be postponed owing to the exceptionally adverse industrial conditions, there is much that can be done without delay. Bricks and mortar alone cannot make a united profession; it is the spirit that counts; and in the decision to extend to other chemists certain facilities which have hitherto been restricted to our own members, we see a manifestation of that desire for unity which alone can lead to the end we have in view.

DANGEROUS DRUGS.

Probably very few chemists see the pharmaceutical and medical press, and those who do are not likely to have read with care the articles which have appeared there recently on the draft regulations made by the Home Office under the Dangerous Drugs Act. These regulations are, however, likely to prove very detrimental to the interests of professional and research chemists. Thus Article 2 prohibits the manufacture of morphine, cocaine, ecgonine, or diamorphine, or their respective salts, or medicinal opium, except by persons properly licensed or authorised to do so, working on premises licensed for the purpose and in accordance with the conditions of such licence or authority. "Manufacture" is nowhere defined in the regulations, and it is a moot point whether a research chemist effecting a new synthesis of one of these alkaloids, or an analytical chemist determining morphine by extracting it from a plant or from the stomach contents of a poisoned animal, would not be "manufacturing" the alkaloid and so infringing the regulations, unless he takes the precaution to acquire a licence for himself and his premises.

Similarly in regard to Article 3, a chemist who effects a synthesis of one of these alkaloids or prepares one of them from a new source will be infringing the regulations if he sends some of his material to a colleague for confirmatory or supplementary tests, or even for inspection, unless he duly acquires a licence to supply the drug and acts in accordance with the terms of such licence or authority. But in this case not only is he himself likely to get into trouble, but the recipient may, unless duly licensed, be in the unfortunate position of having wrongfully secured possession of the alkaloid in question unless he, too, has taken the precaution to secure beforehand the necessary licence or authority. Experience gained hitherto in the working of the Cocaine Regulations shows that a long and tedious delay precedes the granting of a licence, so that a chemist requiring one of the so-called dangerous drugs may in future find that it takes many weeks to obtain even the smallest quantity of them. It also appears that a chemist who has acquired a supply of any of these drugs even for research or other professional purposes and has unwittingly left a grain or two in a bottle in some dusty corner of a stock-cupboard, or has knowingly kept some for purposes of reference or comparison, will either have to destroy it or acquire a licence or other authority to retain it, and if he retains it he may apparently have to produce it when required for inspection by a constable or other duly accredited representative of the Home Office. As for purchasing, keeping and using these drugs for professional purposes, most chemists will think twice before undertaking to keep in order the licences, forms, books, etc., necessary to secure him immunity from the pains and penalties likely to overtake anyone undertaking such an operation.

These are a few of the possible difficulties which will occur to a chemist who casually peruses the draft regulations. The catalogue would no doubt be of considerable length if they were considered with a solicitor, versed in the possible legal twists and turns of an apparently innocent sentence in any of the 15 articles. Matters are apparently somewhat simpler if the chemist happens to be in addition a ship's captain with a ship at his disposal, a registered pharmacist, medical practitioner, dentist or veterinary surgeon; and the professional chemist who has much to do with these drugs, dangerous in more senses than one, will probably find his best course to be to take a medical degree, although even then he will probably need the help of a solicitor—unless he becomes that also—to steer clear of the difficulties which his professional duties may thrust upon him.

Fortunately the regulations are still only in draft, and it is earnestly to be hoped that the Institute of Chemistry and the Society of Public Analysts, which are the bodies best qualified to speak for chemists on such a matter, will promptly call the attention of the Home Office to a fact which it appears to have forgotten, namely, that professional, as well as legal, chemists, occasionally have to deal with these dangerous drugs in the course of their work. A short addition to the regulations indicating that chemists engaged in research, teaching or professional practice are exempt from the general restrictions would apparently meet the necessities of the case.

DISEASES OF OCCUPATION.*

STEPHEN MIALL.

The human body was designed for use in circumstances widely different from those which exist in modern industrial areas, and though evolution can accomplish much it is slow in its operation, and many thousands of years are required for any appreciable change in the qualities of the human organism. As chemical industry becomes more and more complicated it becomes more and more specialised, and we find now men and women who for the whole of their working life are engaged in the same processes, involving exposure to the same chemical compound hour after hour, day after day, and year after year. Whether this is entirely necessary I am not sure, but I wish to indicate very briefly some of the dangers of this sort of life and how they may be prevented or reduced to a minimum.

Broadly speaking, one may say that constant exposure to any chemical compound is likely to be injurious to health, particularly if the compound is likely to give rise to dust, fumes, or gas, and that an abundant supply of fresh air is, as one might expect, the best method of protecting the health of the workers. No doubt some compounds are worse than others, but one may say that all forms of dust and fumes are bad. Constant exposure to coal dust and tar causes what is known as pitch-makers' cancer, the tar being in this case the main irritant; the manufacture of marmalade causes injury to the skin by reason of the peeling of oranges and lemons; miners exposed to coal dust or to a fine silica dust have their lungs affected in a particular way; and workers exposed to dust of metallic compounds, phosphorus fumes, etc., contract specific kinds of poisoning.

Carbonic-oxide poisoning, carbon-dioxide poisoning, poisoning by chlorine, nitrous fumes, ammonia, aniline, tetrachlorethane, turpentine, ether, and acetone are not uncommon in industrial conditions.

The diagnosis of these diseases is often difficult, the cure is often difficult, the conditions under which they are contracted differ enormously, but they are usually all preventible by good ventilation.

The incidence of phosphorus poisoning is well known. Five-and-twenty years ago there were five or six cases a year in this country of phosphorus poisoning out of about 1700 persons employed in phosphorus processes. This has now been reduced to about three cases every two years, and the cause of the reduction is well known: to a large extent red phosphorus is employed instead of yellow phosphorus. The Swiss Government in 1879 introduced a Bill for the prohibition of the use of yellow phosphorus, which in due course became law, but it had to be radically altered because the disease became more prevalent. It seems that the workers imagined that when yellow phosphorus was prohibited they could dispense with a number of precautions which had usually been adopted, and they engaged to a considerable extent in processes where red phosphorus was used under very unhygienic conditions. Finally, the Act was practically repealed, and regulations were adopted by the various cantons which ensured suitable hygienic conditions of work. In France sesqui-sulphide of phosphorus, which gives off no fumes, has for many years been used instead of yellow phosphorus, and phosphorus poisoning has been stamped out in that country. It is interesting to note that whereas good ventilation and the ordinary rules of hygiene have in the main been responsible for the diminution of phosphorus poisoning in this and other countries, the substitution of some other forms of poisoning has been repeatedly advocated; in America there was a practice in match factories of hanging round the necks of the workers small vessels containing turpentine. In Italy a non-poisonous match was made of which the principal ingredient was persulphocyanic acid. The true remedy is a simple and efficacious one. Sir Thomas Oliver, who was a member of the Phosphorus Commission which reported rather more than 20 years ago, and is a recognised authority on dangerous trades, states in relation to phosphorus poisoning: "Of all hygienic measures full and free ventilation is the best."[1]

Cases of poisoning by carbon monoxide, nitrous fumes, ammonia, and other gases are on the increase in this country; there were 90 reported cases in 1913, and 132 cases in 1919; of these 59 in 1913 and 85 in 1919 were cases of carbonic oxide poisoning. Almost all these cases were due to ignorance on the part of the workers of the dangerous character of the fumes, or carelessness. There is no difficult chemical problem involved in the prevention of this form of poisoning; common sense in preventing and detecting leaks in flues will reduce such cases speedily, and workmen should be warned that products of combustion of all kinds are liable to be dangerous to health. A fair number of the cases of poisoning by such gases occur not in a closed room, but out of doors, in a gas works or lime kiln, or plant of that type. All these are preventible. In mines compressed air is largely used for drilling and for ventilation, and a number of deaths have resulted from the overheating of the air compressor and the firing of the oil used for lubricating the cylinders.[2] During the war there were many cases of carbon-monoxide poisoning from the exhaust of small power petrol-engines installed in dug-outs or similar places, and there have been cases of poisoning from the exhaust attached to closed motor cars, motor lorries, and ambulances.

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* From a paper read before the iverpool Section on January 24, 1921.

During the last two or three years cases of chronic benzene poisoning have been notified in this country which have resulted from the employment of benzene as a solvent for rubber, and one case is of exceptional interest. In May, 1918, structural alterations were made in a particular factory, wooden uprights being inserted in certain windows so that they could not be widely opened. In July, 1918, a workman employed in the room was reported as suffering from benzene poisoning, and the case proved fatal.[3] Analyses of the air in different parts of the room showed from two to ten parts of benzene in 10,000 parts of air. The ventilation of the room was improved and no further cases occurred.

Poisoning by turpentine vapour is a problem which has been recently investigated in connexion with the paint industry. It has been long known that many persons are particularly susceptible to the smell of a newly-painted room; the white lead, the turpentine, the linseed oil, and the dryers have all been suspected. I suppose no scientific man now believes in a volatile lead compound given off as a gas or emanation from lead paint, and experiments made during the last twenty years clearly point to turpentine as being the delinquent. Lehmann in 1899 described the symptoms produced in cats by turpentine vapour, and Sir Kenneth Goadby has more recently shown that the poisonous effects produced in animals by exposing them to the vapour given off by painted surfaces are caused by the turpentine content of the paint and not by the linseed oil, dryers, or metallic salt of the paint. Turpentine poisoning produces kidney disease, and seems to cause, or predispose to, gout. Sir Kenneth Goadby states in the joint book by Dr. T. M. Legge and himself[4] that, according to Garrod, gout is constantly occurring among painters.

Dr. G. Arbour Stephens, in a recent paper,[5] reports that during the last six years he has had eight cases where the analysis of the liver showed from about 0·1 to about 0·9 grains of cadmium per pound, with merely a trace of lead. It is presumed from the details he gives that these cases occurred in the zinc-smelting industry in South Wales, and that they were all fatal cases. The symptoms of cadmium poisoning include kidney disease, constipation, and loss of appetite. Zinc is known to be a general protoplasmic poison and, according to Harnack, in the higher animals it causes muscular paralysis and kidney disease. Copper, tin, nickel, and manganese have injurious properties, but the cases of poisoning by these are few and far between.

White lead has been manufactured here since at least the time of Queen Elizabeth, and a variety of lead compounds has been made for a century; lead or lead compounds are used in a remarkably large number of industries and processes, and it is not surprising that by the time the disease had been identified and the method of preventing lead poisoning had become known it had become very prevalent; indeed, as we look back, it seems appalling to think that thirty years ago or less there were in Europe hundreds, or even thousands, of cases of lead poisoning every year, and most of them easily preventible. In many towns lead poisoning was in those days contracted through drinking water kept in contact with lead; in the white lead trade there were in this country nearly 400 cases a year; in the china and earthenware trade there were upwards of 200 cases a year; in smelting, in brass works, in printing, file cutting, glass cutting, shipbuilding and other trades there were over 400 cases, making a total of over 1000 cases per annum.

The attention of the public and of the Home Office was directed to the prevalence of lead poisoning at the end of the last century, when many inquiries were held and considerable information collected. The prohibition of the use of lead compounds in the pottery industry was threatened and various substitutes for lead were suggested. Finally regulations were put into force compelling the removal of dust, the wearing of overalls, regular medical examination, and so on. At the same time the manufacturers of china and earthenware were encouraged to use for glazing purposes an insoluble silicate of lead instead of the very soluble and very dusty white lead formerly used. On the whole the insoluble silicate has been a great boon to the manufacturers of pottery. It has been as satisfactory and cheap to use as the soluble white lead, more uniform in its composition and better to handle, and since its introduction the number of cases of lead poisoning in the china and earthenware trade has steadily declined. It came down from 200 a year in 1900 to 76 a year ten years ago, 15 cases in 1917, 11 cases in 1918 and 21 cases in 1919. The amount of lead in use in the industry has, so far as I am aware, not materially altered; the number of persons employed in the industry has slightly increased and the number of cases has declined to something less than one-tenth.

In the white-lead industry the diminution of cases has been somewhat similar, but even more marked: the number of cases was 399 in 1899, 189 in 1901, 40 in 1915, 18 in 1916, 17 in 1917 and none in 1918. The amount of white lead manufactured in England has declined during that period by about 10 per cent. and the number of persons employed is probably about the same as it was. These striking results have been attained by a careful study of lead poisoning during the last 20 or 25 years. Sir Edward Thorpe, Sir Thomas Oliver, and Dr. Legge, the Chief Medical Inspector of the Home Office, have been largely responsible for these results, and they were assisted in their efforts by a number of Home Secretaries, Inspectors of Factories and private individuals of both sexes. What is the vital factor necessary to the prevention of lead poisoning? Dr. Legge tells us in the Home Office Report for 1918,[7] and these are his words: "On the practical side little more is to be learnt as to how lead poisoning is caused, and it can be taken as axiomatic that all risk lies in inhalation of dust and fumes. These removed and prevented, there will be no lead poisoning." And again, in the Home Office Report for the year 1919,[8] Dr. Legge stated, "that locally applied exhaust ventilation is the sheet-anchor in the protection of the workers from leady dust and fumes and that these alone are the causative agents." With this knowledge it should be possible to reduce yet further the cases of lead poisoning in this country, and the next trade in which a serious effort is to be made is the painters' trade—I mean the painting of houses, ships, bridges and so forth, not the manufacture of paints and varnishes.

It is somewhat unexpected that lead poisoning should be caused not by the particles of lead swallowed by the worker, but by even more minute particles of lead compounds floating in the air and getting into his lungs and there acted on by the juices of the body and so getting into the system. But that this is the usual cause is now generally accepted.

The problem is beset with small difficulties which nevertheless are capable of being surmounted. To begin with, lead poisoning is in many cases by no means easy to identify. A doctor who regularly examines men who are employed in a lead factory can, with a good deal of certainty, state whether a particular man is contracting lead poisoning and should be suspended from work or given employment which does not involve contact with lead compounds. But if a worker goes to the average careful general practitioner and complains of headache, colic, constipation, kidney trouble, and so on, it is pretty nearly impossible for the cause of these symptoms to be identified. There are so many things which will bring about these symptoms. Legge and Goadby—and I quote these as the greatest living authorities on lead poisoning—state in their book[9]: "The headache complained of by painters is probably not due to lead poisoning but, as has been suggested, to turpentine." Turpentine, too, is probably the cause of the gout to which painters are subject. But of one thing we may be certain, if a man goes to a general practitioner and complains of such symptoms as I have mentioned, and states that he is a painter or employed in a lead works, his case will be duly reported as one of lead poisoning. This is not merely an opinion of my own. Legge and Goadby[10] say that there is "an increasing inclination to attribute chronic nephritis and even (without sufficient justification in our opinion) phthisis and pneumonia to lead poisoning on the death certificates of lead workers." I do not deny that lead poisoning exists among painters and others, but I am quite certain that a great many of the so-called cases of lead poisoning in the paint trade and in other trades have no connexion with lead at all. The cases of cadmium poisoning I have already mentioned were some of them certainly, and all of them probably, returned in the statistics as lead poisoning, and no one can say how many cases of turpentine poisoning, indigestion, Bright's disease, etc., among lead workers have been returned as lead poisoning, but the number must be very large.

From time to time proposals have been made to reduce the frequency of lead poisoning by prohibiting the use of white lead in paint, and this question will be considered at the next conference of the International Labour Office at Geneva. I want you as scientific men to consider somewhat carefully what such prohibition means; if the principle is once admitted, we may have to face the prohibition in their own industries of mercury, antimony, copper, arsenic, and a host of other chemicals which are not intended for human consumption. The prohibition of lead in paints only deals with a portion of the problem, and will give a false sense of security to the painters similar to that which operated so dangerously in the phosphorus workers in Switzerland. The proper solution of the problem is that which has been found so efficacious in many other diseases of occupation—fresh air and the removal of dust and fumes. It has been seriously advocated that to avoid lead poisoning houses should be painted with antimony compounds, titanium compounds, and other heavy metal derivatives; the fact is that the dust of nearly all compounds of heavy metals is injurious and that the fumes of nearly all volatile solvents are bad for the health.

It is known to all in the trade that the dust is produced in the dry rubbing-down of old paint by pumice-stone or sandpaper, and, in my opinion, this should be prohibited by law. Rubbing down can be done wet—perhaps not quite so easily, but sufficiently so—and the painters ought to be protected from exposure to dust of old paint.

It is possible to do away with the dust of the rubbing down by keeping the sandpaper moistened with a cheap mineral oil. The sandpaper lasts as well as without the oil and the result upon the paint is fully as good. This is a method with which many German painters are familiar, and if it could be generally introduced into this country a great step forward would have been taken in improving the conditions in house painting and carriage and railway coach painting and ship painting.

Again, there is no reason why painters and those who prepare the paints for them should ever handle or be supplied with dry white lead or any other pigment; these should invariably be supplied ground in oil or some other medium. As to the vapours from the solvents in ready-mixed paints, I saw workmen in America a year or so ago painting the inside of a house by means of a spray, and attached to the painter was a tube communicating with the outside of the house enabling him to breathe fresh air instead of air which, in that particular case, was contaminated by the vapours of benzene, white spirit, and other solvents. If this method of applying paint is not liked in this country, much might be done by the opening of doors and windows of a newly painted room. The question of individual susceptibility has also to be considered, but one may say with a good deal of confidence that the prevention of dust, or its removal by fans or otherwise at the moment of its formation, and the removal of vapours or volatile solvents and the substitution of fresh air will bring cases of painters' colic, whether properly attributed to lead, to turpentine, or any other substance, down to insignificant proportions, and that no other remedy will be equally efficacious.

I am sorry to say that this sort of reasoning does not appeal to such a body as the International Labour Office, and that the very polyglot body which will in due course meet at Geneva will pay but little attention to medical evidence. The Treaty of Peace signed at Versailles provided for the holding of international conferences on questions in which labour is interested, such conferences to be attended by representatives of the governments, the employers, and the workers of every country, and each country is under an obligation to carry out so far as practicable the decisions arrived at by the conferences.

When I was at Washington rather more than a year ago at the first of these conferences we had to consider the health of the workers, and, in particular, the prevention of anthrax, of mercury poisoning, of phosphorus poisoning, and of lead poisoning in so far as it affected women and young persons. We made certain recommendations, one of which has in substance been embodied in the Women and Young Persons (Employment in Lead Processes) Bill, which became an Act of Parliament last session. I am bound to say that though I have in the past had a good deal to do with Acts of Parliament, I did not realise until I was at Washington the extraordinary difficulty of devising rules which would achieve the desired result without unnecessary dislocation of trade, and which were capable of being applied to a variety of countries with different industrial conditions and different methods of domestic legislation. With my recent experience of the Lead Processes Bill, I now realise the difficulties still more acutely, but even at Washington I thought it desirable to suggest to the conference that in view of the complexity of industrial diseases the problems attached to them should be carefully considered beforehand by a committee on which the governments, the employers, and the workers should all be represented. The Conference at Washington unanimously recommended the appointment of such a committee, but no such committee has been so far appointed, and a purely bureaucratic organisation is tackling the problems instead. Governments are particularly susceptible to public opinion, and the public opinion of to-day is largely based on the imperfect recollection of the cases of lead poisoning which occurred five-and-twenty years ago. An instance of this was brought to my notice during the passage of the above-mentioned Bill through

Parliament last session. In supporting the Bill one speaker gave an instance of lead poisoning which had occurred in the paint trade. He gave various details, and I had the incident he mentioned looked into and found it was a case of poisoning by arsenite of copper. This is typical of what happens. The conditions five-and-twenty years ago were so bad, and made such an impression on the social workers of the day, that many people believe that they prevail yet. The fact is that the Home Office, under the guidance of Dr. Legge, has very much reduced lead poisoning, and in the pottery industry has to all intents and purposes abolished it, for there are in that trade no new cases, and the cases which are from time to time reported in the china and earthenware statistics are the deaths of workers as they gradually get old, who contracted lead poisoning many years ago, before the Home Office regulations came into force. But though these facts are known to a few of us, the public as a whole, not only in this country, but in other countries, have not had time to bring their knowledge up to date, and, stimulated by their recollection of bygone days, they have brought pressure to bear on the various governments of the world, and the officials who represent them, to treat the problem as if it still was in the same state as it was a generation ago. The International Labour Office shows no inclination to have such problems scientifically examined by the employers and workers who are most nearly concerned, but they have appointed a permanent official, who seems to be entrusted with the duty of preparing a case for the prohibition of lead, and who has manifested no anxiety to have the assistance of such a committee as was recommended at Washington.

It is not very easy, but it is possible, to frame regulations which would reduce to a minimum the vapours and dust to which painters are exposed, and you may ask me why such regulations have not been, at any rate, given a trial. The answer is that in some foreign countries—for instance, Austria, Germany, and Belgium—they have been tried and have proved beneficial, and I am not without hope that the Home Government may give them a trial. Government Departments at the present time have their hands full of problems, and one cannot blame any department for not desiring to add more to its already heavy load. But I think the Home Office must pay the penalty of success. It has done so much to improve the condition of the workers with so little interference with trade; it has in the past co-operated fairly and reasonably with trades unions and manufacturers, and the tradition which it has created is one not to be lightly destroyed. We chemical manufacturers and chemists, recognising the importance of chemistry to the nation and the fact that we are now only in the beginning of a highly specialised chemical industry, must bring pressure to bear on the Home Office and all other Government Departments concerned to maintain the high standard they have themselves set up and not to be led away by the false gods of the Geneva bureaucracy. The International Labour Office may be productive of much good, but in so far as industrial hygiene is concerned it will accomplish nothing without the co-operation of those primarily affected, and its present methods are tending to promote suspicion rather than confidence.

References.

[1] Oliver, "Dangerous Trades," p. 429.
[2] Journal of State Medicine, Vol. XXVIII., p. 306.
[3] Home Office Report for 1918, p. 79.
[4] Legge and Goadby, p. 109.
[5] Journal of Industrial Hygiene, Vol. II., p. 129.
[6] See Journal of Industrial Hygiene, Vol. II., p. 72.
[7] Home Office Report for 1918, p. 66.
[8] Home Office Report for 1919, p. 61.
[9] Legge and Goadby, p. 120.
[10] Legge and Goadby, p. 56.

BRITISH CHEMICAL PLANT MANUFACTURERS' ASSOCIATION.

Prior to the war British chemical manufacturers procured much of their plant from Germany owing to the difficulty they experienced in obtaining plant in this country which satisfied their requirements. A feeling had long prevailed in the industry that steps should be taken to promote closer co-operation between British chemical and British chemical-plant manufacturers. The need for such action was fully realised by those members of the Association of British Chemical Manufacturers who accompanied the mission sent out by that body under the ægis of the Department of Overseas Trade to inspect chemical factories in the Occupied Area of Germany in May, 1919.

A year later it was decided to invite representatives of the plant manufacturers to meet in conference representatives of the Fine Chemical Group of the Association of British Chemical Manufacturers, to whom the matter was of particular importance. The plant manufacturers agreed that it was desirable that they should be brought more closely into touch with the chemical manufacturers and kept more adequately informed of their requirements, and expressed their willingness to do all in their power to assist the chemical manufacturers. The two conferences then held led to the formation of the British Chemical Plant Manufacturers' Association, which at its inaugural meeting in July last consisted of nineteen firms. Mr. J. H. Rawson (The Widnes Foundry Co., Ltd.), Mr. L. M. G. Fraser (Messrs. W. J. Fraser and Co., Ltd.), and Mr. E. A. Alliott (Messrs. Manlove Alliott and Co., Ltd.) were elected chairman, vice-chairman, and hon. treasurer, respectively, and Mr. W. J. U. Woolcock (General Manager of the Association of British Chemical Manufacturers), secretary. The new Association became affiliated to the Association of British Chemical Manufacturers.

It was agreed that one of the first questions to be considered was the standardisation of chemical plant and apparatus, in which the Germans have reached a very advanced stage. At a joint meeting of representatives of the two Associations it was decided that the question of standardising jacketted-pans with stirrers and covers, boiling-pans and filter-press plant should be the first to receive consideration. The joint sub-committees which were set up to consider these matters are making good progress. Both the British Chemical Plant Manufacturers' Association and the Association of British Chemical Manufacturers are represented on the Sectional Committee on Chemical Engineering of the British Engineering Standards Association, which is also considering the standardisation of chemical plant and apparatus. A joint research committee was also appointed to investigate any new types of plant which may be reported to be in use in other countries and to go into any questions bearing upon the improvement of chemical plant in this country. This committee has invited the co-operation of the Chemical Engineering Group of the Society of Chemical Industry.

Attention having been drawn to the fact that the German plant manufacturers utilise nickel to a much greater extent than the British plant manufacturers, the Committee has now under consideration the uses to which this metal could be put in chemical plant. In this connexion very valuable assistance is being received from the Mond Nickel Co. The question of the use of 12 per cent. chromium steel is also being investigated.

The membership of the British Chemical Plant Manufacturers' Association has increased considerably since its inauguration, and it is hoped that, as the Association becomes more fully representative of the various branches of the manufacture of chemical plant, the object for which is was formed will be achieved, namely, to ensure that British chemicals shall be made with British plant.

THE HABER PROCESS AT MERSEBURG (SAXONY).

J. R. PARTINGTON.

The Haber process carried out at Merseburg differs from that at Oppau (cf. J., 1921, 99 R) in two respects:—(i) The mixture of nitrogen and hydrogen is made directly by treating a mixture of producer (air) gas and water gas, with the addition of steam, by the Bosch process (B.P. 14,508 of 1920); (ii) the purified mixture of nitrogen and hydrogen, before passing to the main catalyst furnaces, is passed through a series of small catalyst furnaces ("Vorofen") to remove impurities (B.P. 5835 of 1911).

There are 31 gas generators, 5 for air gas and the rest for water gas, all the air being provided by two blowers, each of 350 h.-p. The gases are passed through three gasholders, each of 1,765,000 cb. ft. capacity, providing a reserve for fifteen minutes. From these the gases are taken and mixed by blowers. The mixed gas then takes up the requisite amount of water vapour in two rows of six towers, each 82 ft. high, through which hot water is pumped by seven pumps, each of 70 h.-p. The water is warmed in a tower by the gases leaving the heat-exchanger of the contact furnaces for the hydrogen production. There are 48 heat-exchanger towers.

The gases, containing hydrogen, nitrogen, carbon monoxide and some carbon dioxide, now pass, after preheating, to two sets of 24 contact furnaces in which the reaction $CO+H_2O\rightleftarrows CO_2+H_2$ occurs. The gas passes to two gasholders, one of 350,000 cb. ft. and the other of 1,050,000 cb. ft. capacity. Carbon dioxide is removed by washing in 21 to 30 towers at 25 atm., the compression of the gas being in large part effected by one of the cylinders of the 200 atm.-compressors, although a few pumps for 25 atm. are provided. Pelton wheels recover about 40 per cent. of the energy of the released gas, which is utilised to compress the water to 25 atm. The power for this part of the plant is 40,000 h.-p.

For the removal of the carbon monoxide, the gas compressed to 200 atm. by twenty-four 1000 h.-p. compressors and twelve 500 h.-p. compressors is scrubbed in 19 towers with ammoniacal copper formate solution circulated by nine double pumps of 600 h.-p. The carbon monoxide recovered by reducing the pressure in the towers is sent along with water to the hydrogen contact-plant. Six towers for caustic soda remove the remaining carbon monoxide, the soda being circulated by six small pumps.

The gas now passes to nine small contact furnaces ("Vorofen"), in which the remaining impurities are removed by catalyst mass before passing to the main contact furnaces. There are twenty-four main catalyst furnaces, five being in reserve, and twenty-four heat-exchangers. Circulation is effected by eleven pumps of 700 h.-p. each ("Umlaufpumpen"). The ammonia formed is absorbed in water, compressed to 200 atm. by five 100 h.-p. and two 300 h.-p. pumps in twenty towers 39·3 ft. high and 29 ins. diameter. The ammonia solution is passed to an expander, the ammonia gas evolved being absorbed in a separate tower. In the expansion the hydrogen and nitrogen gases dissolved in the water under 200 atm. pressure are liberated; these pass through the ammonia scrubbing tower and are collected in a gasholder, from which they re-enter the circulatory system.

The capacity of the Merseburg factory, when completed, will be 800 tons of ammonia per day.

SOCIETY OF CHEMICAL INDUSTRY.

APRIL MEETING OF COUNCIL.

Among the matters considered at the meeting held on April 15, Sir William J. Pope presiding, was a suggestion made by the Institution of Mechnical Engineers that a further joint meeting of the two societies might be held in the early part of next session. The Institution proposed that the paper should be contributed by one of its members, and should deal with some subject of common interest, such as the construction and manufacture of large-scale chemical plant. The suggestion was cordially approved. The proposal put forward by the Chemical Society is dealt with elsewhere in this issue (p. 139 R).

Sir William Pearce was re-appointed the Society's representative on the Governing Body of the Imperial College of Science and Technology for a period of four years from June 1 next; and the resignation from the Council of Mr. W. J. A. Butterfield on account of pressure of work was accepted with regret. It was reported that the following retire from the Council after the Annual General Meeting:—(*a*) Vice-presidents: Prof. W. R. Hodgkinson, Mr. Robert Mond, and Mr. W. F. Reid. Mr. S. R. Trotman also retires but is eligible for re-election. (*b*) Ordinary members: Mr. C. S. Garland, Sir R. Hadfield, and Dr. F. M. Perkin.

The Government and Parliamentary Committee reported that it had brought before the Board of Trade certain points in the Dangerous Drugs Act, 1920, which may prevent or restrict the development of scientific research in the particular chemicals to which the Act refers. The renewal of the Society's subscription to the Conjoint Board was authorised. Twenty-eight new members were elected; and the report of the Manchester Section was submitted and approved.

ANNUAL MEETING, 1921.

McGILL UNIVERSITY, MONTREAL.

It will be of particular interest to members who are going to Canada to attend the annual meeting of the Society in August, to know that many of the members they will meet there as manufacturers, or associated with manufacturers, are graduates of the university which owes its existence to the exceptional foresight of the Scotchman James McGill, who was born in Glasgow in October, 1744. Exactly one hundred years ago, in 1821, the charter for the establishment of McGill University was granted.

When the visiting members first see the University they will find it difficult to realise that the fine site the University buildings occupy in the heart of Montreal was wild pasture land less than a century ago. But the rapidity of development characteristic of Canada is exemplified in this seat of learning as well as in commerce, manufacturing, and agriculture, and an idea of the vast strides that have been made may be gathered from the fact that when James McGill was one of Montreal's leading merchants the town consisted of only 9000 people, whereas the city's population is now approaching one million. Prominent among the buildings is that of the medical faculty, which brings to mind some of the men most famous in medical science. McGill University has given to the mother country two of her most illustrious professors, Sir W. Osler and Sir E. Rutherford.

Associated with the University are the Forest Products Laboratories of the Dominion Government, the function of which is research and technical service relating to woods and all products derived therefrom. The fact that Canada is the third largest timber-producing country in the world and the largest within the Empire indicates the importance of this work. Canada was the first country in the Empire to establish laboratories of this kind, but the value of research in connexion with forest products is now recognised, and similar institutions have been or are being established in India, in Australia, Great Britain, and Burma. The laboratories at present are organised into four research and technical service divisions, namely, pulp and paper, timber, physics, timber tests, and wood preservation. Visitors interested in work of this kind will be made welcome and conducted through the institution by a member of the staff.

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Members and their friends who propose to attend the Annual Meeting in Montreal and/or the subsequent proceedings in Canada and the United States are reminded that they will be heartily welcome to travel with the President and his party by the s.s. "Megantic," which leaves Liverpool for Montreal on August 12; and that they should notify the General Secretary of their intention without delay.

NEWS FROM THE SECTIONS.

NOTTINGHAM.

At a meeting held on April 13, Mr. S. H. Burford gave an informal account of the work of the Public Analyst. The variety and amount of the information required concerning each sample have much increased in recent times. An analyst must be a student all his life; he must have a wide knowledge of the chemical and legal sides of his profession, and must be able to prepare reasoned and judicial reports. Mr. Burford suggested that the time was ripe for the institution of official laboratories throughout the country, staffed by full-time assistants, and each in charge of an expert who should deal with special substances, *e.g.*, water and sewage in one laboratory, oils and fats in another.

The chairman, Mr. J. H. Dunford, noted that under the Fertilisers Act it might be an offence to sell a product having a higher percentage than that demanded by the Act. Mr. J. White considered that the cares and variety of the work lent it interest. Milk which was clean when first produced should be kept so, not contaminated and then purified. Major S. R. Trotman agreed as to the exacting work of the profession. The analyst had little or no time for research into analytical methods. Mr. H. Droop Richmond said that the analyst, as a consultant, was kept in touch with analytical problems, and he simply had to make time to investigate them. Mr. S. J. Pentecost thought that the results of the Public Analyst should be made available to the public as were those of Medical Officers of Health. Mr. J. M. Wilkie referred to a recent paper by Cofman on the French system of territorial laboratories; and expressed the opinion that the Public Analyst should be better remunerated so that he might have a proper staff. Mr. Burford, in reply, and also Mr. H. Droop Richmond, remarked upon the uniformity of milk samples at the present day, which they ascribed to the elimination of the small dealer, or the blending of small supplies, or the control by analysts employed by large firms.

MEETINGS OF OTHER SOCIETIES.

FARADAY AND OTHER SOCIETIES.

A general discussion, organised by the Faraday Society with the co-operation of several of the technical societies, was held on April 6 in the hall of the Institution of Mechanical Engineers, the subject being "The Failure of Metals under Internal and Prolonged Stress." As nearly all of the 17 papers presented had been printed and circulated beforehand, it was possible to confine the actual presentation of the papers to a few minutes, leaving for the discussions the greater part of the six hours occupied by the three sessions into which the meeting was divided. This arrangement was found to be very successful, and the subject was treated from many points of view, metallurgists, engineers, and pure physicists contributing their quota of information and opinion. Prof. A. W. Porter, Capt. H. Riall Sankey, and Sir George Goodwin, as presidents of three of the co-operating societies, presided in turn.

Dr. W. Rosenhain, in an introductory address, explained how the hypothesis of an inter-crystalline cement had been developed to account for the phenomena of the time-effect in the flow of metals under stress and the spontaneous cracking of cold-worked material. This hypothesis received strong support from Sir Alfred Ewing, speaking from the standpoint of the crystallographer, and it must be said that, although numerous objections to the hypothesis from the theoretical and practical sides were brought forward, no other hypothesis capable of explaining the whole of the facts was suggested. In the discussion of the general question much stress was laid on the part played by corrosion in the initiation of season-cracking, the important investigations of Mr. H. Moore and his colleagues in the Research Laboratory of Woolwich Arsenal containing evidence, derived from a large quantity of experimental material, that such cracking only occurs when chemical action has taken place. Some speakers considered that cracking also occurred in the absence of chemical action, but such a statement is naturally difficult to prove, since minute traces of ammonia, for instance, are sufficient to initiate the action. Prof. C. H. Desch reviewed the facts concerning the inter-crystalline nature of the attack of certain chemical reagents on various metals and alloys, and laid stress on the selective action in such cases. Evidence of the effect of time in bringing about fracture under comparatively low stresses was afforded by Mr. L. Archbutt's observations on the failure of the lead sheathing of telegraph cables, the metal showing inter-crystalline brittleness without chemical corrosion. Dr. W. H. Hatfield's paper opposed the hypothesis of an amorphous film, continuing a controversy begun at a recent meeting of the Institute of Metals.

After the general papers, two groups of papers dealing respectively with steel and with the brasses and similar alloys were taken. Sir Henry Fowler described the failure of some steel locomotive boiler tubes, and several speakers dealt with the remarkable brittleness in steel caused by the action of hot solutions of alkalis and certain salts. Cases of inter-crystalline failure in steel are comparatively rare, but have a special interest. The season-cracking of brass was dealt with from several aspects, much experience having been gained during the war in regard to the behaviour of brass tubes, cartridge cases, and other objects. There were several contributions from Woolwich Arsenal on this subject, and it was shown that the method recommended there and adopted by some manufacturers of annealing at a temperature too low to cause softening of the hard-worked metal is an effectual preventive of season-cracking. It was stated, however, by some speakers that when a correct draft is taken in the drawing of tubes, for instance, the setting up of severe internal stresses is avoided, and annealing becomes unnecessary. The almost explosive cracking of hardened steels was discussed, a paper on this subject by Mr. J. N. Greenwood entering deeply into the theory as well as the practical experience in hardening shops.

The joint discussion must be considered as one of the most valuable of those which have been held under the auspices of the Faraday Society, and the interchange of views has done much to prepare the way for a comprehensive survey of the whole subject of failure under stresses of the kind which present themselves in season-cracking, slowly developing brittleness, and other forms of intercrystalline weakness.

NATIONAL UNION OF SCIENTIFIC WORKERS.

The half-yearly meeting of the Council was held on April 9, in London, the president, Prof. L. Bairstow, presiding. Among the resolutions passed unanimously were the following:—

"That this Council views with misgiving the subordination of scientific workers controlling scientific staffs to non-scientific officials in Government departments. It considers that it is in the best interests of the State that its scientific officers should enjoy the greatest possible freedom from lay interference in connexion with their duties, and should be granted at least equal status and remuneration to that of officials of the highest class in the Civil Service."

"That this Council, having regard to the existing demand for increased educational facilities, deplores the growing tendency of public bodies to reduce expenditure on education, particularly in neglecting to provide for further institutions for the study of science and technology, and by threatening existing institutions with closure, irrespective of their national utility."

A third resolution deprecated the tendency to discriminate between the sexes in the payment of salaries of scientific workers; a fourth urged freedom in research and the undesirability of research work demanding privacy in its pursuit and restriction in publication being undertaken under the auspices of a university; and other resolutions were carried approving the appointment of a consultative committee of representatives of Government branches, and of allowing reduced subscriptions to members resident abroad and to research students and apprentices receiving small grants or salaries.

On April 14 Mr. H. E. Potts, of Liverpool, addressed the London Branch on "The Position of Employer and Scientific Worker in relation to Patent Law." Prof. L. Bairstow presided.

Mr. Potts dealt with the present legal position, the basic principle of which is that in the absence of special contract the invention of an employee, even though made in the time, with the materials, and at the expense of the employer, does not become the property of the employer so as to prevent the employee from taking out a patent. There are, however, many exceptions, and the higher the position of the employee the more likely they are to apply. The four principal exceptions are:—(1) The work may be done under specific instructions, in which case the director may claim to be the inventor and his claim allowed. (2) The work may be considered as a condition of employment and to be included in the duties of the position held. (3) The worker may be in a position of special confidence and have access to special information. The case quoted was that of an English agent for an American firm who attempted to patent in England an improvement on the firm's design. (4) There is frequently an agreement in force between firms and their scientific staffs that all patents arising out of work done shall be assigned to the firm. In return some firms give bonuses for successful inventions, others a share of the proceeds or royalties, and it sometimes happens that a firm only claims a free licence and leaves all royalties to the inventor. Mr. Potts is of the opinion that the Union should decide what is a fair agreement, and that some form of bonus for successful inventions should be offered to stimulate effort in the final stages of invention. He suggested that before formulating a policy in regard to inventions of scientific workers in industry, the Union should investigate the conditions prevailing in America and on the Continent, and should confer with some representative body of employers.

ROYAL PHOTOGRAPHIC SOCIETY.

The meeting held on April 12, arranged by the Scientific and Technical Group, was devoted to a consideration of some aspects of kinematography. Mr. R. J. Trump described an ingenious device for a shutterless, continuous-feed, projecting kinematograph. The light from the projecting lens is reflected by a plane stationary mirror on to the inner periphery of a large wheel rotating synchronously with the movement of the film. The wheel carries a number of plane mirrors arranged in sets of three and disposed at such angles that the image of the moving picture is kept stationary on the screen. An absence of flicker and a reduction of wear and tear of film and mechanism are the advantages claimed for the system.

Mr. H. M. Lomas dealt generally with the limitations imposed by the materials at present available for kinematographic purposes and the difficulties arising from them. Amongst the things specifically mentioned were "static markings," marks produced in the unwinding of the film caused by light flashes due to electrification, and the coarseness of grain of the emulsion which limits definitely the amount of magnification allowable.

THE PHYSICAL SOCIETY.

At the meeting held on April 8, Sir W. H. Bragg read a paper on "The Application of the Ionisation Spectrometer to the Determination of the Structure of Minute Crystals." The method of X-ray analysis of the structure of minute crystals as developed by Debye and Hull necessitates the use of heavy discharges in the X-ray bulb and long exposure of the photographic plate. In the present method, the crystal powder is pasted on a flat surface and placed on the spectrometer table in the manner employed for a large single crystal. The intensity of the diffracted X-ray spectrum corresponding to various angles is measured in the ionisation chamber of the spectrometer in the usual manner. A bulb current of one milliampère is sufficient, and the main part of the spectrum can be determined in about half an hour. The paper was illustrated by the spectra of aluminium, silicon, and lithium fluoride determined in this manner.

A paper on "A New Registering Microphotometer" was submitted by Dr. W. J. H. Moll, of Utrecht. The instrument is designed to record the respective densities of very small areas of a photographic plate. A small incandescent lamp is fitted with a condenser, whereby an image of the glowing filament is cast upon a slit. The photographic plate is disposed between two microscope objectives in such manner that an enlarged image of the illuminated portion of the plate is produced at a second slit, through which radiation transmitted by the plate passes and falls upon an extremely sensitive and robust type of thermopile designed by the author. The plate can be given a slow motion by a micrometer screw, and the beam of light reflected from the mirror of the galvanometer connected with the thermopile records the intensity of the radiation transmitted by the illumined portion of the plate. The device is readily applicable to the investigation of the density of photographic negatives of all kinds, and the extremely sensitive thermopile employed should find application in a large number of other directions.

ROYAL SOCIETY OF ARTS.

A paper on "Low Temperature Carbonisation and Smokeless Fuel" was read by Prof. H. E. Armstrong on April 13, Sir Arthur Duckham presiding.

In the first part of his paper, Prof. Armstrong dealt with the use and abuse of coal as fuel, and outlined the early history of "coalite." Early in 1913 a large German company was about to associate itself with the English undertaking, but the war intervened, and it was not until 1919 that development work was resumed at Barnsley. A carbonising plant built to the design of Mr. T. M. Davidson had been in operation since November, 1920, and was undoubtedly a success. The trouble due to expansion of the fuel on carbonisation had been overcome by building the ovens with upright walls and fitting them with perforated hanging plates movable in a vertical plane over a narrow range; the coal was filled into the space between the side of the oven and the opposed face of each plate, thus enabling the width to be varied. During carbonisation the plates exerted pressure on the coal, and the volatile matter escaped through the perforations. When carbonisation was complete, after 5—8 hours, the "coalite" slabs were allowed to fall into an air-tight, water-cooled chamber. It was essential that the "coalite" should not be exposed to air during cooling. The product contained 10—15 per cent. of volatile matter and burned with a bright flame; the coal oil was well within the Admiralty specification for fuel oils; and motor spirit could be obtained from the liquid and scrubbed from the gas.

In the long discussion which followed, the chairman said that he had seen the plant at Barnsley and was convinced of its success. The great drawback to the process, however, was the lack of an absolutely satisfactory balance-sheet, and this was the reason why gas engineers had fought shy of it; the success of the process would depend on the value of the "coalite" and the value of the oil. Dr. J. A. Harker said that in an investigation carried out under the auspices of the Ministry of Munitions, it was ascertained that from 1 ton of coal the yield of crude "coalite" was 14 cwt., of which rather less than 13 cwt. was saleable. Economically, the process depended upon selling the 13 cwt. for the same price as that paid for 1 ton of the coal, and of paying operating costs from the sale of by-products. He thought that the margin between profit and loss would be very narrow. Among the points raised by subsequent speakers were the friability of fuel produced by low-temperature carbonisation processes and the necessity for briquetting, the economy that should be obtainable with the Neilsen process of internal-heating of the retorts with water gas, and the need of eliminating as much ash as possible by properly washing the coal.

In his reply, Prof. Armstrong said that, as a professor, he was not concerned with the cost of the process. The public should be prepared to pay more for "coalite" than for coal because it did not burn away so rapidly and was smokeless. The yield of fuel oil was about 1 ton from 10 tons of coal.

THE CHEMICAL SOCIETY.

A meeting was held at the Institution of Mechanical Engineers on April 7, Sir William Pope presiding, when Dr. F. W. Aston delivered a lecture on "Mass Spectra and Atomic Weights." On April 21 an ordinary scientific meeting was held at Burlington House. Sir James Walker, the new president, gave a short address, and then six of the nine papers on the agenda were presented in abstract. The paper of most immediate interest to technical chemists was that by Dr. J. A. Newton Friend on "A Colloid Theory of the Corrosion and Passivity of Iron and of Ferrous Salts," of which the object was to show that the reactions involved are not purely ionic but colloidal.

When iron is exposed to moving water containing dissolved air the rate of corrosion increases rapidly with the flow of the water until it reaches a maximum, after which further increase in the velocity of the water causes a retardation of corrosion, none taking place at about five miles per hour. It was suggested that iron slowly oxidises in aerated water to form colloidal ferrous hydroxide, which then undergoes alternate oxidation by air and reduction in contact with metallic iron, the latter suffering rapid corrosion. If, however, the colloid is swept from the surface of the iron as rapidly as it is formed this autocatalytic action cannot take place, and the iron oxidises but slowly. The theory was tested by determining whether or not the rate of corrosion is influenced by factors that increase the stability or effect the precipitation of positive sols. This was shown to be the case. Thus the presence of anions such as Cl, SO_4, and Cr_2O_7 is known to cause the precipitation of colloidal iron hydroxide, Cl being least and Cr_2O_7 most effective. These ions also influence the rate of corrosion, Cr_2O_7 exerting the most marked inhibiting action and Cl the least. It was also shown that protective colloids, such as gelatin, acacia, and albumin, inhibit corrosion, and that there was a remarkably close relationship between their action in this respect and their influence on the catalytic activity of colloidal platinum upon hydrogen peroxide. Suspensoid colloids are very sensitive to "poisons," and attention was drawn to the fact that poisons also inhibit corrosion, arsenious oxide being particularly effective. Radium rays, which precipitate iron hydroxide sol, likewise retard corrosion. Colloidal iron hydroxide is very stable in pure water, and is not precipitated by boiling. Addition of small quantities of an electrolyte, such as sodium chloride, causes marked precipitation if the temperature is raised. An explanation is thus forthcoming of the remarkable and otherwise inexplicable fact that whereas sea-water is more corrosive than fresh water at 10° C., it is less corrosive at 30° C. It was pointed out that passivifying agents are those which possess anions capable of precipitating positive sols; and the oxidation of ferrous sulphate in neutral or alkaline solution was attributed to the presence of a sol.

Dr. F. Challenger contributed a paper on the interaction of the halogen derivatives of tertiary aromatic bismuthines with organo-derivatives of magnesium and mercury; Prof. G. T. Morgan outlined some new work by himself and Mr. J. D. Smith on the constitution of simple and complex cobaltic quinoneoxime lakes; and Dr. N. V. Sidgwick and collaborators presented three papers dealing with the influence of position on the solubility of the substituted benzoic acids, on the solubility and volatility of the mono- and dinitrophenols, and on the solubility and volatility of the chloro- and nitro-anilines and their acetyl derivatives.

NEWS AND NOTES.

AUSTRALIA.

Cobalt Ore in Queensland.—The Imperial Mineral Resources Bureau has received from the Department of Mines, Brisbane, an account of the development work which has been carried out on the recently discovered deposit of cobalt ore in the Cloncurry district (*cf.* J., 1920, 378 R). Two shafts, 250 ft. apart, have been sunk on the general strike (underlie), the first to a depth of 112 ft. and the second to 92 ft. In No. 1 shaft from the surface to 42 ft. the ore (cobaltite) averaged 4—5 per cent. metallic cobalt over an average width of 5 ft. A similar ore body was found at 80 ft. No. 2 shaft has met with ore varying from 1 to 3 ft. wide of similar value to that encountered in No. 1 shaft. Development work is not sufficiently advanced to show if the ore occurs in short shoots or as a continuous run.

Shale Oil in New South Wales.—The Joadja oil-shale mine, which was formerly worked by the Australian Kerosene Oil and Mineral Co. but closed down about 20 years ago as a result of American competition in oil, is now being reopened by the Shale Petrol Oil Co., Ltd., a new company that proposes to work the coal, which occurs abundantly on its property, as well as the shale. The mine is situated near Mittagong, on the main line between Sydney and Melbourne. On distillation, the shale gives 73 per cent. of volatile hydrocarbons and an average of 106 galls. of crude oil per ton of shale. The old company produced considerable quantities of motor spirit, which in those days was considered a nuisance and therefore burnt on the spot.

Tasmania.

Shale Oil Distillation.—The Rialton-Latrobe shale works has started to send crude oil to Melbourne to be refined. The company owns shale deposits which are expected to produce about 300 million galls. of oil, and is installing a plant which should be able to distil about 350 tons of shale per day. Demand for oil is growing almost daily, owing to the steady increase in the use of motors for farming operations.

Cement Manufacture.—The hydro-electric plants which are being laid down in Tasmania are making very heavy demands upon the supplies of cement available in the island. As a result of this, new cement works are being erected by the National Portland Cement Co. on Maria Island, and by the Fingal Cement Co. on the mainland; the former company is planning an output of 30,000 tons per annum, and the latter is expecting to produce in July next.

Lessons in Economic Independence.—The manufacture of calcium carbide was developed in Tasmania during the war, and was safeguarded owing to shipping difficulties. It was just beginning to become well established when the shipping situation improved, and the old importers began to attempt to recover their market by offering carbide at a "cut" price. In consequence, the Federal Government prohibited the importation of carbide, except under licence, for a period of twelve months, by which time it is anticipated that the new tariff law will be in operation.

A different story is that of imported petrol, which is not produced in the country. The importers of this commodity (the price of which is fixed by law) applied to the Court for permission to increase the price, and when they were asked by the President of the Court what would happen if their request were refused, they replied that the importation would cease. The application was granted.

JAPAN.

The Camphor Industry.—The efforts made by the Japanese Camphor Monopoly to increase production resulted in 1919 in a yield of nearly 6·7 million lb., of which 5·7 million lb. came from Formosa. Although this was nearly double the 1918 output, it was approximately 20 per cent. less than that for 1916, a year of record production. On account of the rapid growth of the Japanese celluloid industry, the exportable surplus is becoming smaller, and in 1919 the United States received only 1·42 million lb., compared with 2·5 million lb. before the war.—(*Chem. Ind., Mar.* 14, 1921.)

FRANCE.

Industrial Notes.—*Coal.*—One immediate effect of the coal strike in Great Britain was to stimulate the French coal trade. The fear of a short supply of coal has been strongest in the south-west and south, where British coal is mainly consumed. It is estimated that the increase in orders arising from this cause is about 350,000 tons.

According to the report of the Central Committee of the French Coalfields, the production of coal in France rose from 22,341,864 metric tons in 1919 to 25,274,294 t. in 1920. Importations in 1920 were 24,056,262 t. of coal, 3,985,213 t. of coke, and 2,070,893 t. of briquettes, compared with 22,005,000 t., 1,723,619 t., and 1,180,139 t. respectively in 1919. British exports to France in 1920 amounted to 11,432,000 t. of coal, 667,000 t. of coke, and 887,000 t. of briquettes, and showed a great reduction over the figures for 1919; this was due to increased supplies from Germany and the Saar basin, and to importations from the United States. The total supplies in the past year were thus 48,359,000 t. of coal, 4,767,000 t. of coke, and 4,129,000 t. of briquettes, or 4 million tons of coal and 2½ million tons of coke in excess of the supplies in 1919; but the ratio of production to consumption, 50 per cent., compares unfavourably with that for the last pre-war year, viz., 65 per cent. The production of the Saar and Lorraine coalfields—about 7 million tons—is about 4 million tons less than the consumption in the recovered provinces. There is, moreover, little prospect of increased output in view of the 8-hour day and the diminished efficiency of the individual miner.

Metallurgy.—The greatly increased production of cast iron and steel resulting from the return of Alsace-Lorraine has emphasised the importance of finding outlets abroad, and this question is being considered by the Ministries of Commerce, Public Works, and Industrial Reconstruction in conjunction with representatives of the industry. As a result of combination between important metallurgical firms, production costs have been reduced and the general commercial organisation improved and strengthened so as to obtain a firmer hold on foreign markets. The Comptoir Sidérurgique has lately added to its list of members the iron and steel firms of the Saar basin, but as these refuse to enter the export trade, the Comptoir is at present dealing solely with the home trade, although its chief function should be to promote exportation.

Chemical Industry.—Soap can now be exported freely, and it is to be hoped that complete freedom will soon be forthcoming, as this would be followed by a material reduction in prices. The slump on the chemical market still continues, and were it not for exportation the situation would be critical. Abroad there is acute competition from England, Germany, and the United States, and the last-named country is daily gaining a firmer hold on the South American market, formerly supplied by Germany.

The projected publication of all chemical abstracts in *Chimie et Industrie* and *Le Bulletin de* *la Société chimique de France* (*cf.* J., 1921, 127 R) is generally welcomed by chemists, if only on account of the time that will be saved in searching in one or two journals for matter which may now be dispersed in many.

UNITED STATES.

Recent Research in Applied Chemistry.—*Carbon Black.*—A new process for producing carbon black is being rapidly perfected. It consists in forcing natural gas, consisting of nearly pure methane, through molten metal and collecting the resulting carbon black by the Cottrell process, hydrogen being liberated as a by-product.

Syrup from Sweet Potatoes.—The Bureau of Chemistry has devised a process of manufacturing a table syrup from sweet potatoes, of which large quantities do not now reach the market. The syrup is rich in sugar, has a good brown colour, is palatable, and suitable for baking, for making sweets, and for table purposes. It is considered by many to be equal to a high-grade, cane-sugar table syrup.

Tarnishing of Metal Surfaces.—A research laboratory which is investigating problems relating to the protection of metal surfaces has found that tarnish on highly-polished machine parts is often due to sunlight. This result is brought about by very slow breaking down of some of the hydrocarbons in the lubricating oil, carbon being deposited and hydrogen set free. The brown stain produced is indelible, but harmless.

Testing the Fastness to Light of Dyes.—A series of tests to ascertain the best means of determining the fastness to light of dyes has been completed, and the decision reached that the violet carbon arc gives results which agree best with the effect of sunlight. The white-flame carbon arc gave rather better results, but was only half as rapid. These carbon arcs were found to be superior in constancy to the mercury arc.

Chlorination of Natural Gas.—The chlorination of natural gas in localities where other economical use is excluded seems a certainty for the near future. Investigations conducted by the Bureau of Mines have shown the possibility of producing the four chloromethanes, etc., with a 90 per cent. or better yield, and the only remaining problem is that of heat control.

Applications of Carbonyl Chloride.—Phosgene is known to be very reactive at or above 450° C., and Dr. Charles Baskerville has utilised it to convert the oxides of aluminium and cerium, insoluble in acids, and the oxides of zirconium and thorium, which are soluble only in boiling concentrated sulphuric acid, directly into water-soluble chlorides or oxychlorides. Bauxite and carborundum gave ferric and aluminium chlorides, and zircon yielded zirconium chloride, the ferric chloride from the contaminating iron being distilled off owing to its greater volatility. The method consists in simply heating the pulverised material in a quartz tube in a current of the gas.

Wood-alcohol Poisoning.—Many deaths have occurred in the United States as the result of drinking wood alcohol, and various preventive measures have been discussed. It was pointed out by Mr. A. E. Outerbridge that the addition of a small amount of fluorescein to denatured alcohol, although invisible in the concentrated solution, would give on dilution a yellowish-green fluorescence that would immediately be noticeable and would therefore serve as a deterrent. Accordingly a sample of denatured alcohol containing 7 mg. of fluorescein per 100 c.c. was submitted to the Prohibition Commissioner, who gave the opinion, in a letter to *Chemical and Metallurgical Engineering* of March 2, that it was inexpedient to use fluorescein for this purpose, as the colour that becomes apparent on dilution might prove objectionable in some manufacturing processes; the voluntary addition of fluorescein to a factory stock of completely or specially denatured alcohol, however, was highly desirable.

Potash Discovery in Texas.—A large deposit of alunite has been discovered near Floresville, Texas. Three outcrops of the mineral occur, separated from one another by six to twelve miles, and the outcrop of highest grade mineral covers about 20 acres. The commercial value of the alunite is said to be about $250 per ton, and should it be possible to exploit the deposits commercially, an important source of potash will be made available.—(*Oil, Paint and Drug Rep., Mar.* 14, 1921.)

The American Oil Chemists' Society.—For many years the leading chemists in the cottonseed oil industry have been associated in the Society of Cotton Products Analysts, an organisation which was devoted primarily to perfecting methods of analysis used in the cottonseed industry. Certain specific qualifications for membership limited this society in numbers to those highly specialised but ensured a large amount of important investigation work. During the war the United States was drawn into a large international trade in several of the vegetable oils which became keen competitors of cotton oil, and this caused a commensurate widening of the society's interests with the result that at its annual meeting in May, 1920, it was re-organised under the name of the American Oil Chemists' Society. All persons engaged in chemical work relating to fats, oils, waxes, and allied substances are eligible for active membership in the new society, provided they have had at least five years' chemical training. Meetings are held once a year, usually in May, and in conjunction with the Inter-State Cotton Crushers' Association. The Society publishes regularly its transactions and maintains the Chemists Section of the Cotton Oil Press, a journal devoted exclusively to the interests of the edible vegetable-oil industry. Membership, however, is not limited to chemists and technologists engaged exclusively in the edible oil trade, but includes also those concerned with its industrial or technical aspects. Anyone interested in the activities of this new organisation may obtain further information from the secretary and treasurer, Mr. T. B. Caldwell, Wilmington, N.C.

BRITISH INDIA.

Chemical and Allied Industries in Madras.—The Acting Director of Industries, Madras, in a summary of industrial intelligence appearing in the first number of the *Journal of Indian Industries and Labour*, points out that the high price and scarcity of fuel is one of the main difficulties which hinder the development of industries in Southern India. Numerous discoveries of coal have been made in the Presidency from time to time, the most promising being those made in the Godaveri and Kistna Districts. Endeavours to interest firms and syndicates in the exploitation of the fields have in so far been successful that a leading Madras firm has been granted a prospecting licence over a total area of 173 sq. miles in the Kistna district and over 80 sq. miles in the Godaveri district.

The question of a possible cement industry at Bezwada has been investigated for the past three years, and it now seems probable that it will soon be established, as the Government has recently approved of the grant to a syndicate of rights in certain districts for mining and quarrying the limestone and shale required in the manufacture. One of the conditions governing the grant of the concession is that within four years an output of at least 30,000 tons of cement per annum must have been attained.

A collection of samples of aromatic gums and oleo-resins, available in commercial quantities in Madras forests, was made for a large London firm of manufacturing chemists, which was also supplied with full information about the sources of supply and quantities available. The firm is considering the establishment in Southern India of a factory for the manufacture of drugs and essential oils. Another London firm of manufacturing chemists is contemplating the erection at Vizagapatam of a factory for producing crude alkaloids, principally strychnine, from nux vomica. The firm has already acquired the necessary land, and a factory will be erected at an early date.

The exploitation and development of the deposits of phosphatic nodules in the Trichinopoly District, with a view to supplying this fertiliser at cheap rates to the ryots of the delta districts, has been under consideration for some time past. It is proposed to establish an experimental works for the production of finely-ground phosphate and for the exploitation of the gypsum and red ochre associated with the nodules.

The industrial chemist attached to the Department of Industries is investigating at the Indian Institute of Science, Bangalore, the fermentation vat for indigo dyeing, and the fermentation of prickly pear. The production of power alcohol and the suitability of South Indian woods for the manufacture of paper and pulp are also being considered.

The manufacture of inks and vinegar is being carried out at the Government Industrial Laboratory, Coonoor. Experiments in progress at the laboratory include the manufacture of casein glue, lacquer for tins, sealing wax, and an investigation into the available sources of pectin.

As a result of the experiments in the manufacture of glue which were undertaken by the Department, agreements have been made for the establishment of a small experimental factory in Madras. Other schemes being considered by private firms, with the assistance of the Department, are the manufacture of finished rubber goods, extraction of oil from groundnut and gingelly seeds, manufacture of pottery and porcelain ware, and a factory for the production of cane sugar.

Second Forecast of Winter Oilseeds.—The total area under rape and mustard, so far reported, amounts to 2,793,000 acres, or 22 per cent. below the revised figure at the corresponding date of last year. The total area under linseed is reported to be 1,784,000 acres, which is 23 per cent. below last year's second forecast. In both cases these figures exclude the "mixed" crop of the United Provinces. The condition of the crops is reported to be generally fair.—(*Ind. Tr. J., Mar.* 18, 1921.)

SOUTH AFRICA.

Mining in the Protectorate of South-West Africa.—Since the country was opened for prospecting on March 1, 1920, there has been considerable mining activity; copper ore has been found in the Kaokoveld, galena and silver in the Kalkfontein district, discoveries of tin and iron are reported from the Usakos district, and oil-shales have been discovered in the Gibeon district. Copper ore traffic, which recommenced in August, 1919, has been steadily maintained, and an average of about 3000 t. per month has been dispatched during the last few months. The tin mines have been more active, and although they are not able to record a large production, owing to lack of machinery, the output has increased considerably. About 50 tons of scheelite was produced at the Natas mine in 1919, the output of marble has notably increased, and 948 tons of salt was dispatched by rail during the year. The value of the diamond output for 1919 was £1,500,000, the production (426,180 carats) showing a large increase over the previous year.

A writer in the *Star* (Johannesburg) states that the tinfields situated in the Karibib and Omaru districts extend over several hundreds of square miles and that their production will expand considerably. One of the properties has recently been acquired by a leading Rand mining house, and another has been taken up by an East London company. Mining methods have hitherto been very primitive, but modest profits have been won. The obstacles to development are lack of water and transport.—(*S. Afr. J. Ind., Feb.*, 1921.)

GENERAL.

Finsbury Technical College.—When the projected closing of the City and Guilds Technical College, Finsbury, was announced last July, students past and present, and many friends who appreciated the educational facilities offered at this College during nearly forty years, endeavoured to avert the disaster. A Defence Committee was formed which was composed largely of former students, and urgent protests were evoked almost spontaneously from the great professional institutions. As a result, two petitions were sent to the City and Guilds of London Institute, one signed by the presidents of many of the professional institutions, and the other signed by a large number of former students of the College and friends interested in its continuance. In reply the petitioners were informed that there was every hope that the College would be continued, with the help of the Board of Education and the London County Council, for a period of five years. The success of these negotiations has now been announced, and it is hoped that the future of the College is now assured. The members of the Defence Committee are very grateful for the help given by many friends of the College during the critical period which has now passed.

The Imperial Mineral Resources Bureau.—The second annual report, covering the year 1920, shows that excellent progress has been made in the organisation and work of the Bureau. Good headway has been made in the collection of information, both from the appointed corresponding members and from unofficial sources, and in its co-ordination and tabulation. The information so obtained is made available to all Government Departments both at home and overseas, as well as to co-operating technical institutions and societies; individuals and companies may also avail themselves of the service of the Bureau, but these are charged a nominal fee if information is asked for which involves special work by the staff. Important work is being done with a view to introducing a unified system of mining and metallurgical statistics, including the standardisation of weights and measures, and at the suggestion of the Bureau a resolution was passed at the Imperial Statistical Conference to the effect that when the projected Central Bureau of Statistics for the Empire comes into being, it shall work hand-in-hand with the Imperial Mineral Resources Bureau. It has also been arranged that the Bureau shall have charge of the mineral exhibit at the British Empire Exhibition to be held in 1923. The Technical Advisory Committees constitute an important feature of the organisation; they are fifteen in number and comprise 148 of the leading authorities on the respective minerals and the industries associated therewith. Sir Herbert Jackson is chairman of the Committee for Chemical Industries.

The work of indexing technical literature of the Empire and of foreign countries is being actively prosecuted, and during the year ten pamphlets, each relating to one metal or mineral, were published; twelve more were nearly ready for press at the end of the year, and another eight were in course of preparation. Future publications of this type will include statistics relating to labour, health, and accidents. A special and comprehensive work on the "Iron Ore Resources of the World" is also being prepared. The Legal Section of the Bureau has completed two volumes dealing with Mining Law in Nigeria and West Africa, respectively, and a third on South Africa, with special reference to the Transvaal, is nearing completion. The Bureau was supported financially by grants which amounted to £20,452, of which £10,000 was from the Imperial Government, and the rest from the Overseas Dominions and the National Federation of Iron and Steel Manufacturers. The paid staff numbers 45 persons, exclusive of the chairman, Sir Richard Redmayne, and the vice-chairman.

"Cobalt (1913—1919)" (Imperial Mineral Resources Bureau pamphlet, 22 pp., price 9d.).—Although the results of research indicate the possible value of cobalt metal as a constituent of alloys and in electro-plating, commercial interest lies chiefly in the use of its salts in the pottery and enamelling trades. The oxide has largely superseded smalt (silicate) as a colouring agent owing to its greater purity, uniformity, and lower cost. For special purposes the carbonate, chloride, sulphate, and, less commonly, aluminate, phosphate, arsenate, and nitrate are also employed. As driers in the paint and varnish trade the acetate, resinate, and oleate of cobalt are used. During the war a cobalt-chromium alloy ("Stellite") found some application in the manufacture of cutting and milling tools.

The world's annual production of cobalt oxide up to 1913 amounted approximately to 250 tons. Before the discovery of cobalt ore in Ontario, New Caledonia produced over 80 per cent. of the world's supply. In recent years Canada has been the chief producing country, the actual figures for 1918, quoted from the Report of the Canadian Mines Department, being metallic cobalt 196 tons, cobalt oxide 512 tons, and other compounds 83 tons. The production of Katanga, in the Belgian Congo, promises to be of some importance, and considerable interest has lately been shown in a new deposit which is being actively exploited in the Cloncurry district of Queensland (*cf.* J., 1920, 378 R, and this issue, p. 148 R).

The price of cobalt oxide in July, 1919, was quoted in London at 7s. 8d. per lb. For some unexplained reason it rose during 1920 to 20s. per lb., but has since fallen to 16s. per lb. nominal.

British Yeast.—The "Report on Yeast" by the sub-committee of the Standing Committee on Trusts (Cmd. 1216. 2d.) states that compressed distillers' yeast has almost entirely superseded brewers' yeast for use in bread-making, and that nearly the whole home-supply is produced by three firms, two of which are located in Edinburgh and one in Belfast. The pre-war selling price, inclusive of delivery, was about 19s. per 56-lb. basket, and the present price of about 39s. represents an increase in the cost of bread of less than 0·1d. per loaf. No information concerning production costs was forthcoming. From the time it leaves the distillery until it reaches the consumer, the yeast is controlled by the Wholesale Yeast Merchants' Association, together with its subsidiary yeast dealers' associations, and these in turn are controlled or influenced by the representatives or agents of the distillers; no person outside these associations could obtain supplies of British yeast.

Before the manufacture of compressed distillers' yeast was started in this country in 1886, foreign yeast was imported at the rate of about 282 tons per week, but owing to the competition of the home-produced material the imports had declined to about 200 t. per week immediately before the war. From 1915 to 1917 imports were gradually restricted, and from April, 1917, to April, 1919, were prohibited. Importation was resumed in 1919, and now about 70 tons is being imported weekly. During the period of prohibition the output of British distilleries rose from about 400 t. to 650—700 t. a week, and at the present time the home consumption is estimated at about 635 t. a week. When, during the war, the distillers were invited by the Ministry of Munitions to enlarge their plants in order to meet the entire home demand, the Ministry is said to have given them some sort of assurance that importation would be restricted after the war; but this has been denied. The conclusion arrived at by the sub-committee is that unrestricted imports form the only safeguard against a combination of distillers arbitrarily fixing the price to the consumer, and should it be found necessary to protect the British distillers against imported yeast, such action should be preceded by legislation to protect the consumer by providing for the surveillance of trusts and monopolies.

Use of Peat Fuel on Swedish Railways.—Extensive trials have shown that peat, reduced to powder or briquetted, makes an excellent substitute for coal as fuel for locomotives (*cf.* J., 1919, 145 R), and the Swedish Railway Board has taken over the plant at Hästhagen bog, near Vislanda, which cost 975,000 kronor (krona = 1s. 1½d. at par) and has a capacity of 30,000 tons per annum. The power required by the plant is small, and the peat is air-dried as far as possible, the hardest and driest lumps being used as ordinary fuel and the remainder pulverised or briquetted. Various new machines and devices for digging, transporting and drying peat have been devised by Engineer Eklund, and it is proposed to manufacture them in a new factory.—(*U.S. Com. Rep., Feb.* 25, 1921.)

The Norwegian Paper Industry.—In this industry there are 26 cellulose mills, 63 wood-pulp grinding mills, 48 paper and cardboard factories, and about 15,000 workers. The production in 1918 was 438,438 tons of cellulose and wood pulp, and 116,889 t. of paper and cardboard. At present there is little demand for paper, stocks are accumulating, and the situation is not bright. Many mills have had to reduce their output, some have been closed, and about one-half of the 80 paper machines is lying idle. The production of wood pulp has as yet only been reduced where it is required for paper-making; stocks of cellulose and wood pulp are not so large as those of paper.—(*U.S. Com. Rep., Feb.* 6, 1921.)

Projected Salt and Magnesium Industries in Norway.—The A.-S. Norske Saltverker is erecting a factory for the extraction of salt from sea water in Fjotlandsvaag. The factory will have a capacity of 5000 t. per annum, and will probably be finished in the summer. It is intended to utilise the magnesium salts for the production of about 100 tons of magnesium yearly, *i.e.*, about one-quarter of the world's present production. The magnesium will in part be made into alloys for constructing motors, aircraft, balances, conductivity wiring, etc. For such purposes the alloy or metal will be covered with a protective film of oxide by a process, discovered by the engineer Backer, which consists in boiling in water under high pressure for about 15 minutes; the resulting coating is said to be firmly adherent even when hammered, and to act as an electrical insulator.—(*Chem. Ind., Mar.* 28, 1921.)

Belgian Coal Output in 1920.—The Belgian output of coal in 1920 was 22,414,000 metric tons, which compares with 18,483,000 t. in 1919 and 22,842,000 t. in 1913. The average output per shift per face worker was 2802 to 3696 t. Coke production has now attained 1,800,000 t., as against 757,000 t. in 1919 and 3,523,000 t. in 1913, and the coke-ovens consumed 2,313,000 t. of coal, of which 379,000 t. was imported. Owing to increased use on the Belgian railways, the output of briquettes rose from 2,458,000 t. in 1919 to 2,922,000 t. in 1920. Exports, largely to France, amounted to 1,638,000 t. of coal, 219,000 t. of coke, and 215,000 t. of briquettes; imports were 1,541,000 t. of coal, 124,000 t. of coke, and 152,000 t. of briquettes, Germany, Great Britain, and the United States supplying 1,211,000 t., 301,000 t., and 28,000 t., respectively. The total consumption of fuel amounted to 22,449,000 t., or 86 per cent. of the consumption in 1913.—(*Iron and Coal Tr. Rev., Mar.* 25, 1921.)

Position of the German Potash Industry.—In reply to an inquiry made by the French delegates at the Brussels Conference, the German delegates stated that the German potash industry was now operating 201 shafts, 74 factories which produce chloride and sulphate of potassium, 8 special factories where salts from other works are treated, and also factories that work up by-products, such as bromine and magnesium chloride. Owing to the small demand and lack of coal, production was being still further reduced, especially in Hannover. The present production, however, could be more than doubled without sinking new shafts or erecting new plant, etc., and it could be increased many times were transport and labour conditions slightly better. Handling facilities were good, the works were all interconnected by rail, and adequate means were available for conveyance by water to the seaports.—(*Z. angew. Chem., Feb.* 11, 1921.)

The German Leather Industry in 1920.—On the whole, 1920 was a good year for German leather manufacturers, but fine leather-ware was in little demand. When the industry was freed from Government restrictions in August, 1919, the importation of raw materials again became possible, and such war-time substitutes as wooden soles, paper fabric, etc., disappeared completely, although wooden heels are still made. As the export duty on leather products restricted the proper development of the export trade, the Government removed the duty so far as it affected the finer grades of leather and leather goods. The export trade fluctuated during the year and is still unsatisfactory, as the former German markets are well stocked and are making strenuous efforts to ward off German competition. The German leather factories use mainly lignite as fuel; they have suffered from frequent interruptions in the supply of electric light and power, and the increased railway rates, which became effective on December 1 last, will be acutely felt by the industry.—(*U.S. Com. Rep., Mar.* 3, 1921.)

Sugar Production in Europe.—During the last six years the production of sugar in Europe has fallen by about 66 per cent., and Germany, formerly the largest exporter, cannot now supply her own needs. The European sugar production for the years 1913–14 and 1919–20 is given below:—

	1913-14.	1919-20.
	Million metric tons.	
Germany	2·738	0·750
Austria-Hungary (former)	1·688	0·585
Holland	0·231	0·238
Sweden	0·137	0·145
Denmark	0·146	0·160
Belgium	0·229	0·127
France	0·781	0·175
Russian Empire (former)	1·688	0·350
Other countries	0·543	0·300
Totals	8·181	2·830

Apart from political considerations, the large decrease in Germany is ascribed mainly to the high price of fertilisers, particularly nitrogenous fertilisers, which are chiefly used in great quantities for sugar-beet. Germany has lost important producing areas, but certain sugar factories in South Germany have formed an "Interessengemeinschaft" to further the development of the industry.—(*Schweiz. Chem.-Z., Mar.* 1, 1921.)

Indigo in Java.—Indigo is grown on about 40 estates in Java as well as by the natives. The estate indigo contains from 60 to 80 per cent. of indigotin, but the native product, which is used locally, contains only 0·75 to 1 per cent. Before the war Holland took most of the powder and Singapore the paste, but since 1917 Japan has purchased the bulk of the powder. Singapore became an important market for the product during 1920.—(*U.S. Com. Rep., Feb.* 19, 1921.)

Drug Manufacture in Petrograd.—During the period July—September, 1920, four State drug factories and four private factories were in operation. Two of the State factories produced:—Liquid medicines, 14,924 kg., powders, 7509 kg., ointment, 2444 kg., plasters, 65 kg., chemical and mineral preparations, 789 kg., chemical dressings, 1,500,000 kg., and iodine, 150 kg. The other two factories and the private laboratories manufactured sweetening material solely, the production in the abovementioned period amounting to 196 kg. There was a general shortage of all raw materials, particularly fats.—(*Chem. Ind., Mar.* 28, 1921.)

PERSONALIA.

Dr. Morris W. Travers has been elected president of the Society of Glass Technology for the ensuing year.

The new chair of biochemistry at Cambridge University, to be known as the Sir William Dunn chair, has been offered to and accepted by Prof. F. Gowland Hopkins, fellow and prelector in biochemistry at Trinity College.

Mr. F. W. Harbord has been elected president of the Institution of Mining and Metallurgy in succession to Mr. Frank Merricks. Mr. Benedict Kitto, and Prof. R. Peele, of Columbia University, New York, have been elected honorary members.

Prof. E. Lagueur has been appointed professor of pharmacology and director of the Pharmacological Institute in the University of Amsterdam.

The eightieth birthday of Prof. K. Graebe, the discoverer of synthetic alizarin, was celebrated recently in his native town, Frankfurt-on-the-Main. Prof. Graebe occupied the chair of chemistry at Geneva University from 1878 to 1906, and last year he published a history of organic chemistry.

Prof. R. Scholl, of Dresden, has been appointed to the chair of chemistry at Vienna, in succession to Prof. Schlenk, who is to succeed Emil Fischer in the University of Berlin.

The following appointments, etc., at German Technical "Hochschulen" have been notified:—Prof. Schuberg to be head of the chemical department at Charlottenburg, in succession to Prof. Dolezalek; Dr. L. Moser to the chair of analytical chemistry at Vienna; Dr. Alex. Classen is retiring from the chair of inorganic chemistry and electrochemistry at Aachen.

We record with regret the death, on April 10, of Mr. J. W. Leitch, the founder and head of John W. Leitch and Co., Ltd., Milnsbridge Chemical Works, Huddersfield.

The death is announced of Mr. John H. Yocum, president of Yocum Faust, Ltd., London, Ontario, a well-known leather chemist who joined this Society in 1894.

Prof. A. W. Reinold, formerly professor of physics in the Royal Naval College, Greenwich, died on April 11, at the age of 77 years.

The death is announced of Dr. P. Jannasch, formerly honorary ordinary professor of chemistry in the University of Heidelberg, aged 79.

PARLIAMENTARY NEWS.

HOUSE OF COMMONS.

Farina Mills.

In reply to questions put by Mr. J. Gardiner concerning a company formed to erect mills in this country for the production of farina, Sir P. Lloyd Greame said that the company was promoted by private individuals with Government support. The capital invested by the promoters was £20,000, and the cost of the four mills acquired at King's Lynn, Boston, Monikie, and Hull was £247,000. The King's Lynn and Boston mills had produced 1875 and 150 tons of farina respectively, but the Boston mill had been sold, and the other mills were on sale. Private subscribers were paid out at par.—(Apr. 11.)

British Dyestuffs Corporation, Ltd.

Sir P. Lloyd Greame, in reply to an inquiry by Mr. Hogge concerning the appointment of three new directors to the board of the above Corporation, stated that the appointment of directors (other than Government directors) to the board did not require the consent of the Government, as the latter had no controlling interest in the Corporation.—(Apr. 11.)

Chemical Warfare Committee.

Mr. Rawlinson asked the Chancellor of the Exchequer whether his attention had been called to the hardship caused to the members of the Chemical Warfare Committee by the Treasury rule that to obtain remuneration they must prove actual pecuniary loss due to their service on the Committee; and whether, as some of the members received fixed incomes or were engaged in research work, he would arrange that members entitled to remuneration should not be compelled to show actual loss.

Lieut.-Com. Young, in a written reply, said that members of commissions and committees were usually willing to serve their country without specific remuneration in cases where such service did not entail actual loss, and he saw no reason to depart from the usual rule in this particular case. —(Apr. 12.)

Basic Slag.

Sir A. Boscawen informed Sir J. Norton-Griffiths that the prices of basic slag, 84 shillings per ton from January to May, 1920, and now 127s. 6d. per ton, were maximum prices which the manufacturers, by agreement with the Ministry, undertook not to exceed. The higher price was sanctioned in view of the increased cost of transport and production, and because without such an agreement the price would probably have gone still higher. The agreement expired on May 31, 1921, and would not be renewed. Export of basic slag was prohibited, save under licence, as the supply of the higher grades was insufficient to meet home demands. The Government had never owned any basic slag other than the small quantities required for use in the Ministry's farm settlements or experiments. No licence was required for the importation of basic slag, and during the six months ending March 31, 1921, 15,769 tons, worth £125,832, had been imported, the bulk of which was probably unground.— (Apr. 13, 20.)

Coal Industry (Capital, Profits, and Wages.)

Mr. Bridgeman, answering Mr. Hurd, said that, exclusive of coke ovens and by-product plant, the total capital employed in the coal-mining industry was approximately £180,000,000, not including new money invested in the industry during 1920. The percentage of profits earned, before deducting profits carried to reserve and capitalised, was estimated as follows:—Average of five years ended March 31, 1914, 9·8 per cent.; average 1915—1917, 17·0 per cent.; average 1918—1921, 15·5 per cent. During the seven years ended March 31, 1921, it was estimated that £40,000,000 was appropriated from profits to capital, leaving available for dividends, partners' drawings, and income-tax, a sum representing a possible yield of 11¾ per cent. on the average capital employed. The total amounts of wages paid were £91,000,000 in 1913 and £261,721,000 in 1920; the profits in these two years were £21,000,000 and £27,000,000, respectively.—(Apr. 19, 22.)

REPORTS.

General Report on the Economic Situation of Denmark at the Close of 1920. *By* R. M. Turner, *Commercial Secretary to H.M. Legation, Copenhagen. Pp.* 54. *(London: H.M. Stationery Office.* 1921.) *Price* 1s. 3*d. net.*

The present unfortunate economic situation in Denmark is to a large extent due to the high prices that have to be paid for imported fuel, which is now obtained mainly from the United States. It is therefore not surprising that increasing interest is being taken in the development of home resources, in water-power schemes, electricity, and the extensive deposits of peat. A marked feature of the past year has been the depreciation of the Danish krone, which has been investigated by a Government commission but so far without result, although it may soon lead to a revision of the tariff system. Unemployment and the cost of living have both steadily increased, and the curtailment of credits by the banks has affected trade and industry.

The condition of agriculture, the main source of wealth, is favourable. Sugar-beet was cultivated over about 95,300 acres, or some 6400 acres less than in 1919, when the production was 135,000 metric tons; about 10,000 t. of the 1919 crop was exported. Experiments on the production of sugar-beet seed have so far not led to any tangible result, but the seed industry in general has been developed, and more potatoes have been cultivated and exported. The oil-crushing and margarine industries have been active, and it is noteworthy that the importation of edible oils has diminished, and that of oil-bearing nuts and seeds has increased. The fact that it is advantageous to export butter in order to improve the exchange augurs well for the prospects of these industries. Of margarine some 45,000 t. was produced during 1920, which is about 75 per cent. of the output capacity; and nearly all of it was consumed in the country, regulations as to packing, colouring, etc. effectually preventing exportation. Much of the raw material for the leather industry is obtained in the country; imports of heavy hides and tanning extracts and exports have decreased, but on the whole the industry, which is practically controlled by a single group, has been well employed. Shortage of fuel has seriously affected cement and brick manufacture, and the textile industry has been passing through a bad time owing to shortage of imported raw materials, fuel, and foreign competition. These causes, together with increased labour costs, have also affected the metal industry, which on the whole has been fairly well occupied, and the chemical industry, which, in addition, has had to contend with German competition. The manufacture of fertilisers has continued favourably notwithstanding importation of foreign superphosphate, etc., which depressed prices. During the first nine months of 1920, 82,095 t. of raw phosphate was imported, compared with 35,698 t. for the whole of 1919, and the corresponding figures for superphosphate are 45,565 t. and 66,864 t., respectively. In the same period there was imported 42,234 t. of Chilean and Norwegian saltpetre, representing a decrease of 21,098 t. over the corresponding nine months of 1919, but the imports of the Norwegian fertiliser, 32,819 t., increased by 10,492 t. The importation of potash fertilisers decreased from 92,142 t. to 3126 t. for the nine-month period. Imports of glass and glassware, and of porcelain and faience (mainly from Germany) declined notably; and of metals there were imported increased quantities of cast iron (28,600 t.), black plates (44,000 t.), tinplate (6700 t.), and raw lead (3700 t.).

The main facts in the economic position to be noted by U.K. manufacturers are, apart from the question of exchange, the existence of large stocks in the country and foreign, especially German, competition.

Rapport sur le Commerce et l'Industrie de la Suisse. 1919. *Pages* 495. *Publié par le Vorort de l'Union suisse du Commerce et de l'Industrie.* 1920.

The year 1919 was a chequered one for the Swiss heavy chemical industry. Liquidation of war stocks and widely fluctuating prices combined to make markets unstable, and until stocks had been disposed of towards the middle of the year and the textile industry had resumed activity, production was not always able to meet demand. The shortened working day also restricted production.

The foregoing applied chiefly to sulphuric acid, but oleum was always in demand. Pyrites was in sufficient supply, but the price went up instead of down. Switzerland was fortunate in not having embarked on the manufacture of sulphuric acid from calcium sulphate, as this process has not fulfilled expectations. Lack of coal and sulphuric acid prevented over half the hydrochloric acid and sodium sulphate plants from working, in spite of the brisk demand; imported rock salt was used and hydrochloric acid was imported at prices below the production cost in Switzerland. The manufacture of nitric acid from atmospheric nitrogen by the arc process, which was actively pursued during the war, fell off, and as many consumers imported saltpetre or nitric acid from abroad, the factories diverted production to sodium and calcium nitrates. The soda industry, which suspended work at the end of 1918, recommenced on a small scale in June, 1919, and by the end of the year was able to meet requirements. In the fertiliser industry supplies of phosphates were no easier to obtain than during the war, and prices remained high; but little basic slag was imported, although potash salts were in plentiful supply. The electrochemical and electrometallurgical industries suffered under the prevailing economic depression, and many of the works had to strike out along new lines. Owing to the termination of war contracts only 2 or 3 of the calcium carbide factories that were running in 1918 continued to work. The following quantities of carbide were exported in the years 1913—1919 (in metric tons):—31,790, 35,950, 55,410, 58,010, 59,450, 75,840 and 36,890 t.

The manufacture of cyanamide was affected by a smaller demand and foreign competition, the output being reduced from 40,000 t. in 1918 to 9000—10,000 t. in 1919. Little improvement could be foreseen for the aluminium industry, which has suffered from the development of the industry in England, the United States, and Scandinavia. The production and export of ferro-alloys were very small. Some progress was made in the electric-smelting of iron scrap, and the output was estimated at 16,000 tons; smelting direct from the ore would only be commercially feasible in Switzerland were electric current available at about 1 centime per kw., and this is not possible. The export trade in chlorates and perchlorates was extremely small, and the manufacture of perchlorates had to be discontinued. The market for caustic soda, chloride of lime, chlorine, and similar products was fairly good, and the manufacture of sodium, although not for export, was continued at the Monthey works of the Swiss Society of Chemical Industry, where it is used in the manufacture of synthetic indigo. The country's requirements in chlorine are covered by the output of the Monthey works, and the production of this gas has apparently become stationary. Manufacture of perborate was abandoned, as the current consumption was too great, but the output of other minor products, such as hydrogen peroxide and persulphate, improved. Electrolytic oxidation and reduction are used in the Swiss dyeworks, but details are not available.

From the middle of 1919 the demand for coal-tar dyes has been so great that the factories have not been able to meet it; the production could be increased many times were sufficient raw materials, especially coal, available. Exportation of dyewares to France in 1919 was very severely handicapped by the French official regulations and duties. No difficulty was experienced in exporting to England, where the Trade Licensing Sub-committee granted import licences freely. All the dye-works manufactured a wider range of colours, although not to the same extent as before the war. Production of synthetic indigo was restricted by the shortage of aniline oil; nevertheless, both production and sales were about twice as large as in 1918. Mainly owing to excessively high prices, to a great extent adventitious, the export trade in synthetic perfumes was very much better than in 1918, but, in spite of this, the outlook for the industry was held to be very doubtful. The mineral colour and varnish industry experienced a bad year as it was congested with stocks purchased at war-time prices and could not dispose of them. The manufacture of explosives was necessarily curtailed, and the future of this industry was not regarded cheerfully except in so far as the development of water-power resources would call for considerable supplies

Of the many difficulties which confronted the manufacture of pharmaceutical chemicals, the reduction in the length of the working day was the greatest and had the most effect in raising production costs; in the latter part of the year firms which did not also manufacture dyes were scarcely able to make ends meet. Exportation was small and very difficult owing to collapsed exchanges; and the fairly satisfactory results which were obtained were due to the absence of foreign competition. According to one authority, the year 1919 was worse than any of the years of the war. The soap industry also recorded an unfavourable year. Large quantities of raw materials purchased at high prices during the war were delivered to the last kilogram, and at the same time buyers stood aloof waiting for prices to fall, and foreign wares, particularly Spanish, were thrust upon the market. The slump in the building trade naturally affected the cement industry which, in spite of lower prices, worked at only half-capacity. Manufacturers of porcelain and faience had to contend with importation from Germany and Lorraine, but makers of common pottery were in a better position, as their raw materials are found in the country. Glass manufacture was badly hit by the shortage of fuel; before the war the cost of fuel was 15—25 per cent. of that of the finished product, now it is about 60 per cent. The three glass-bottle factories produced regularly, and a small proportion of the output was exported.

Other subjects included in this comprehensive report are textiles, metals, engineering, preserved foodstuffs, leather, rubber, etc., together with much statistical information.

GOVERNMENT ORDERS AND NOTICES.

Former Enemy Aliens and the Dyestuff Industry.—The Board of Trade announces that by notice published in the *London Gazette* of April 8, the provisions of Section 11 of the Aliens Restriction (Amendment) Act, 1919, which imposes restrictions on the acquisition by former enemy aliens of certain kinds of property, have been applied to the following industries, namely, the manufacture of synthetic organic dyestuffs, colours, or colouring matters, and the manufacture of organic intermediate products used in the manufacture of synthetic organic dyestuffs, colours, or colouring matters. The effect of this is to make it unlawful for any former enemy alien to acquire either in his own name or in the name of a trustee any interest in the industries in question, or any share, or interest in a share, in a company registered in the United Kingdom which carries on the industries.

Orders under the German Reparations (Recovery) Act, 1921.—German Reparations Recovery No. 1 Order, 1921.—Any article imported before May 15 is exempted from the provisions of the Act if it be proved (*a*) that a contract was entered into before March 8, 1921, and (*b*) that not less than 20 per cent. of the purchase price was paid before the said date in pursuance of such contract, or (*c*) that the physical possession and property in the article, the subject of the contract, had passed to some person other than a German national prior to the said date.

German Reparations Recovery No. 2 Order, 1921.—This Order extends the provisions of Section 4 of the Act so as to include contracts for resale entered into by importers before March 8, 1921.

Petroleum Production (Transfer of Powers) Order, 1921.—By an Order-in-Council the powers of the Ministry of Munitions under the Petroleum (Production) Act, 1918, and all rights and liabilities acquired or incurred by the Minister of Munitions under that Act, have been transferred to the Board of Trade, such powers to be exercised through the Secretary for Mines.

Export of Industrial Explosives.—The Board of Trade (Licensing Section) has issued an open general licence permitting the export, as from April 14, 1921, of the following explosives:—Rockite, super-cliffite No. 1, super-cliffite No. 2, superrippite, tonite or cotton powder No. 1.

Certificates of Origin.—The following goods, *inter alia*, are exempt from the requirements of certificates of origin:—Marble, limestone, sandstone, ganister, sulphur, iron and copper pyrites, mechanical pulp, and iron and other metalliferous ores and scrap (except from Denmark, Holland, and Belgium). Declarations of non-German origin are still required.

LEGAL INTELLIGENCE.

Breach of Contract for Sale of Soda Products. *John Batt and Co., Ltd.* v. *Aniline Dye and Chemical Co.*

On April 12, in the King's Bench Division, Mr. Justice Shearman had before him in the form of a special case the arbitration proceedings between John Batt and Co., Ltd., London, and the Aniline Dye and Chemical Co., which referred to the breach of a contract for soda ash and caustic soda.

Counsel for John Batt and Co. stated that his client's complaint was that the chemical company had broken its contract to sell to Batt and Co. 400 tons of soda ash and 100 tons of caustic soda; and that under the arbitration proceedings Batt and Co. asked for the difference between the contract price and the market price. The chemical company had failed to ship the goods. The point raised by the sellers was under the red ink clause in the contract, viz., "The price of goods sold under the contract may be advanced from time to time, and the present price of raw materials and the current rate of wages increased owing to the action of the Government; and the buyer shall have the option of saying whether on the advance he will accept it or refuse to have the goods." Counsel added that before the breach of the contract no notice was given by the sellers to the buyers.

His Lordship upheld the arbitrator's award, and ordered the chemical company to pay Batt and Co. £7050 and costs.

COMPANY NEWS.

UNITED ALKALI CO., LTD.

Addressing the adjourned twenty-ninth and the thirtieth ordinary general meetings, held at Liverpool on April 20, Mr. Max Muspratt, the chairman, said that difficulties had been enormously accentuated by the greatly increased cost of all construction, the slowness of delivery of plant, and the high cost of production, especially of fuel and labour. The first had led to an expenditure of several hundred thousand pounds in excess of estimates; the second had delayed the complete operation of more economical processes in time to meet the boom demand; and the third had reduced profits to a minimum. Since trade had fallen off production had been curtailed, and at the present time several of the company's works were completely, and others partially, shut down. On the other hand, deferred repairs had been overtaken and new processes introduced. The Leblanc soda process had been superseded by the electrolytic process. The discovery of brine at Widnes indicated an improvement in the company's position, and since the beginning of this year brine from this source had supplied all the electrolytic plants.

Dealing with finance, Mr. Muspratt stated that during the last six years the company had paid £1,759,233 in taxation, as against £1,847,905 in net dividends, and that £2,500,000 had been spent on plant in accordance with instructions from the Ministry of Munitions. By making certain adjustments of the debenture capital it was hoped to avoid offering any new share capital for public subscription. In spite of considerable profits made in 1920, it was considered unwise to pay a dividend on the ordinary shares. In view of the falling costs of living, proposals had been made to the employees that they should accept reductions in wages. The company was now producing on the best and most economical lines, and a comparatively small increase in the demand for its products would put it on a sound basis of profitable manufacture.

Dr. G. C. Clayton stated that, owing to the coal strike, the works were rapidly starving for coal, and in the course of a few days would have to close down.

THE BRITISH PORTLAND CEMENT MANUFACTURERS, LTD.

At the tenth ordinary general meeting, held in London on April 12, the Hon. F. C. Stanley, chairman, said that in 1920 production, deliveries, and profits of cement had all been better than in any year since the outbreak of war. The difficulties attending manufacture and distribution became less severe during the latter part of the year, and though at the moment there was more than a lull in business, there were indications that the tide had turned, and he looked forward to a revival in the demand for cement. The demand had been very acute during the whole of the past year, and every effort had been made to meet it; if manufacturing cost was high, the average price was good and the profits satisfactory, especially in the export markets. Although prices in the export markets were far above those ruling at home, the company had voluntarily restricted its export sales in order that the great home demand might be satisfied. The output had gradually improved during the year, and at its close was approximately equal to that of the last pre-war year. The Cement Marketing Co., which was formed in 1920 to distribute the company's production and that of certain allied companies, had fully justified expectations.

Whereas the balance of profit brought forward from 1918 was £136,264, subject to excess profits duty, that now carried forward was £181,477, after deducting an ample sum for the duty and the corporation profits tax. The trading profit, less repairs and renewals, taxes, etc., was £558,618, and after meeting debenture interest, etc. and putting £150,000 to general reserve, the balance was £323,406 (issued capital, including debentures, £3,698,080). Owing to the need for conserving resources, the dividend for the year on the ordinary shares would be limited to 15 per cent. (8 per cent. for 8 months in 1919). The capital account had been increased by a large sum representing the value of the three subsidiary undertakings (Tolhursts Cement Works, Ltd.; Trechmann, Weekes and Co., Ltd.; and the Artillery and Albion Cement Co., Ltd.) which had been transferred from the investment account, and a heavy mortgage on one of these had been paid off. In addition, the expenditure of £237,000 on works and properties had been added to the fixed capital account, and provision would have to be made for the works now being erected in India. Owing to these considerations it had been deemed advisable to issue to a financial group the whole of the remaining debenture stock, viz., £509,533, on the basis of an annual yield of 7¼ per cent.

SHAWINIGAN WATER AND POWER CO.

The report of the Shawinigan Water and Power Co. states that the capacity of the company's power stations is now about 220,000 electrical h.-p., compared with 20,000 h.-p. in 1905. The company began operations in 1900 and during the last five years the load has grown at an average rate of 20,000 h.-p. per annum. A further 40,000 hydraulic h.-p. will be developed in 1921 and this will lead to an increase in the company's revenue of over $1,000,000 per annum. The output of 1,140,759,076 kw.-hr. in 1920 is only paralleled by one or two other industrial centres in North America. The assets of the company are valued at $34,000,000, mortgage bonds etc. at $13,000,000, and reserves amount to $4,000,000, or, roughly, 20 per cent. of the isued share capital.—(*Canad. Chem. and Met., Mar.*, 1921.)

OFFICIAL TRADE INTELLIGENCE.

(*From the Board of Trade Journal for April* 14 *and* 21.)

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W. 1, from firms, agents, or individuals who desire to represent U.K. manufacturers or exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department and quoting the specific reference number:—

Locality of firm or agent.	Materials.	Reference number.
Australia	Pottery	*412/20/7/531
Canada	Drugs, etc.	458
„	Olive oil	461, 483
„	Pharmaceutical chemicals	468
„	Glass, china	469
„	Drugs, etc.	†
Belgium	Ink	497
„	Machine and industrial oils	498
Denmark	Sugar	503
Hungary	Skins, tanning materials, leather	507
Italy	Agricultural chemicals, fertilisers, soap, varnish, dyes	473
„	Tinplate, black plates, terne plates	474
Netherlands	Fine chemicals	509
Poland	Tinplate	510
Spain	Chemicals, pharmaceutical products, shoe leather	476
Switzerland	Rubber tyres	477
Mexico	Photographic materials	516

* The Official Secretary, Commercial Information Bureau, Australia House, Strand, London, W.C. 2.

† The High Commissioner for Canada, 19, Victoria Street, London, S.W. 1.

Markets Sought.—A Canadian tannery has for disposal 5000 sides of harness leather from 14 to 30 lb. to each side.

A Canadian tannery offers 30 tons of medium wax splits, all shorts, 50 per cent. seconds. [Inquiries to the Canadian Government Trade Commissioner, 73, Basinghall Street, London, E.C. 2.]

TARIFF. CUSTOMS. EXCISE.

Australia.—The application of the new customs duties on soda ash and caustic soda has been postponed until October 1, 1921, and those on iron and steel tubes and pipes [Tariff Item 152A] until January 1, 1922.

Belgium.—The customs duties have been modified on, *inter alia*, gold, silver, platinum, perfumery, pottery, porcelain, glassware (except bottles, vials, demijohns and carboys).

The maximum "coefficient of increase" which the Government is authorised to apply has been raised to 6; articles upon which it has been increased include candles, cocoa, yeast, matches, certain metals, paper, cardboard, certain hides and skins, liquid carbonic acid, acetic and sulphuric ethers, soap, glass bottles, vials, demijohns, and carboys.

British India.—The complete text of the revised schedule of customs duties is set out in the issue for April 14.

Among the articles that are free of import duty are salt for industrial use, raw hides and skins, metallic ores, certain oilseeds, fertilisers, woodpulp, paper-making materials, quinine, and trade catalogues (by post).

Articles that pay duty at special rates include sugar, salt, petroleum, opium, and matches. Other goods pay *ad valorem* duties varying from 2½ to 20 per cent. The duty is 11 per cent. on chemicals, drugs, medicines not otherwise specified, dyeing and tanning materials, paints, colours, glass, earthenware, china, leather, paper, cardboard, oils, oilcake, perfumery, pitch, tar, soap, starch, and candles.

Canada.—Recent customs decisions affect circular sheets of steel, and aluminium, copper, brass, zinc, and other metal circles.

Chile.—The new tariff modifications came into force on February 23. The duty is unchanged on condensed milk, raw cocoa, sugar, petrol, paraffin wax, mineral oils (not specially mentioned), prussian blue, and ultramarine.

Among the articles on which the duty has been doubled are chocolate, vinegar, perfumery, and perfumed soap.

As from February 14 the import of opium, coca, cocaine, and substitutes thereof is subject to licence from the Director-General of Health.

Egypt.—Groundnuts and helba may now be exported without special licence.

The tariff valuations of iron and steel manufactures with effect from March 16 to May 15 are given in the issue for April 21.

France and Algeria.—The import duties have been modified on aluminium, celluloid, and bottles.

France.—The prohibition of the export of soap has been withdrawn.

Germany.—The import of oleomargarine and premier jus is no longer subject to licence.

Do. (Occupied Territory).—The full text of the customs organisation and import and export regulations is set out in the issue for April 21.

Gold Coast.—An export duty of ½d. per lb. has been levied on kola nuts exported by sea, with effect from February 4.

Greece.—Caustic soda may again be imported. The export of olive oil of the present crop is permitted subject to a special licence.

Mexico.—Crude mineral oil, sulphuric acid, blasting powder, and other explosives not specially mentioned may be imported duty free as from March 14.

Montserrat.—Calcium arsenate may be imported duty free.

Netherlands.—Bones, fertilisers, and sugar may now be exported.

New Zealand.—As from January 27 the import of opium, morphine, heroin, and cocaine is subject to permit from the Minister of Customs.

Norway.—The export of all goods is permitted except, *inter alia*, explosives, bones, cellulose, wood pulp, copper ore, cyanamide, gold, silver, hides, skins, leather, nitrate of lime, paper, cardboard, and superphosphates.

Palestine.—The import of opium and saltpetre is subject to special licence.

Portuguese East Africa.—A copy of the new customs tariff for Manica and Sofala may be seen at the Department, 18, Queen Anne's Gate, S.W. 1.

Spain.—The import duty on sugar has been raised to 60 pesetas per 100 kg. as from March 30.

As from April 1 the import duties on the various classes of paper which were suspended in August last have been reimposed.

Sweden.—Export prohibitions have been withdrawn from certain hides and skins, etc.

Switzerland.—The import is prohibited, except under licence as from April 8, of thick leather, calf leather, and other leather for boot and shoe uppers.

United States.—Articles affected by the proposed emergency tariff legislation include olive oil, groundnut oil, sugar, molasses, syrup, flax-seed, and condensed milk.

TRADE NOTES.

FOREIGN.

St. Vincent in 1919.—Cotton was planted on 6633 acres, the largest area ever recorded, and the production was 212 tons, compared with 195 t. in the previous year. The sugar-cane industry is resuming its former importance and the manufacture of syrup has increased considerably; but very little sugar is produced. The production of syrup and molasses was 170,842 gallons. Owing to low prices and large stocks, the area under arrowroot has decreased; only 1002 tons was exported, compared with 2225 t. in 1918. There was also a decline in the area under groundnuts, of which 11,329 bushels was exported. The Agricultural Department has continued its work on cotton breeding, on the production of supplies of pedigree Sea Island cotton seed, and on the manuring and planting of cotton and arrowroot. The exports, valued at £149,749, included:—Arrowroot, £42,222; cotton, £66,782; syrup and molasses, £10,726; cassava starch, £4836; and groundnuts, £5098. Over 58 per cent. of the exports was taken by the United Kingdom, 27 per cent. by the British West Indies, and 8·7 per cent. by Canada. Of the imports, valued at £185,128, the United Kingdom, United States, and Canada supplied 31·4, 29·2, and 29·6 per cent., respectively (*cf.* J., 1920, 404R).—(*Col. Rep.—Ann.*, No. 1063, *Feb.*, 1921.)

German Exports to England.—German exports to England increased greatly during the last six months of 1920; during the third and fourth quarters of the year they included:—Dyestuffs, £1,000,000, £3,040,000; glass bottles, £127,000, £164,000; crude zinc, £67,000, £315,000; and raw sugar, £12,000, £240,000.—(*Handelsmuseum, Mar.* 31, 1921.)

The Japanese Dye Market.—Increased activity followed the introduction of the new import tariffs in August last, but so long as the weaving sheds are working short time it is unlikely that consumption will equal supply. Towards the middle of November there was a general rise in prices with the exception of Malachite Green, Sulphur Black, and Basle Blue. The suggested amalgamation of Japanese dye makers will probably not materialise; some of them, apparently, only desired it in order to avoid liquidation.—(*Chem. Ind., Mar.* 28, 1921.)

Foreign Company News.—*Poland.*—The Polish Dyeworks Company, recently founded in Wierzchucin-Krainski, near Bromberg, has purchased a disused factory, and will manufacture mineral colours, lakes, and varnishes.—(*Chem. Ind., Mar.* 28, 1921.)

Holland.—The Netherlands Dyestuff Factory has been formed in Amsterdam by certain Dutch banks and chemical firms to manufacture and trade in dyewares and other chemical products. The capital is 5 million florins (florin = 1s. 7·8d. at par).

Germany.—The new Distillers' Yeast Syndicate, founded in March, represents nearly 95 per cent. of the German production, the combined output of its constituent firms being about 37,500 metric tons. The syndicate (Brennerei-Hefesyndikat G.m.b.h.) will fix prices and control sales, and it is expected to be much stronger than the former combine.—(*Handelsmuseum*, Mar. 24, 1921.)

France.—The Cie. Industrielle des Verreries à Vitre (capital 14·9 million fr.) is building large works at Cussett, in Allier, to manufacture window-glass by the Fourcault process on a very large scale. The company has taken over the Verreries Valentin Mesiner at St.-Etienne, and has also acquired the Aniche works of the Société Industrielle de Verrerie.—(*Bd. of Trade J., Mar.* 24, 1921.)

Japan.—The formation of a combine of Japanese producers of sulphur colours, initiated by the Teikoku and Kompira dye companies, has made further progress, and a commission has been appointed to investigate the financial status of 18 firms producing sulphur colours in Tokyo, of which the total paid-up capital is about 4 million yen. If the combine is effected a new undertaking will be formed with a capital of 6 million yen.—(*Chem. Ind., Mar.* 21, 1921.)

United States.—A new company entitled "The Industrial Potash Corporation" has been formed with a capital of 30 million dollars to exploit the extensive alunite deposits near Marysvale, Utah, and to erect a plant to treat some 10,000 t. of material daily, mainly with a view to producing potassium sulphate for agricultural purposes.

It is reported that the Du Pont Co. is considering plans for the erection of a dry-colour plant to be the largest in the world, and to add a new paint and varnish plant to the existing units.

The capital of the Allied Chemical and Dye Corporation is to be increased from $48,043,675 to $113,043,675.—(*Oil, Paint and Drug Rep., Mar.* 14, 1921.)

Norway.—With the exception of the cellulose factories and the Norsk Hydro-Elektrisk Kvaelstof A.-S., Kristiania, which manufactures Norwegian saltpetre and ammonium nitrate, all other chemical and allied undertakings have been forced to curtail production or to close down. Three firms in the carbide industry have ceased to produce and the remainder are working at 30—40 per cent. capacity. About 40 per cent. of the mines is being worked. The Glomfjord zinc-smelting works, a private undertaking run largely with Swedish capital, has suspended operations, and it is reported that negotiations for its sale to English interests are proceeding.—(*Chem. Ind., Mar.* 14, *Apr.* 11, 1921.)

Sweden.—The net profit for 1920 of the Svenska Tändstiksfabriks A.-B., which comprises the majority of the Swedish match factories, was 12,950,000 kronor (krona=1s. 1½d. at par), and the dividend 14 per cent. (capital 45 million kr., reserves 65 million kr.). The production of 600,000 cases represents about 20 per cent. of the world's output; the turnover was 105 million kr., of which 95 million kr. was in respect of foreign sales. Prospects are now more favourable, as Japanese competition is much less keen than it was before the war. Owing to the high exchange value of the yen the Trust has been able to capture the Indian market, and in Australia racial feeling has told against the Japanese. The Trust anticipates that by April its stocks will have fallen to a normal level.

The liquidation is announced of the well-known oil-mill and soap works Malmö Oljeslageri and Happachs Sapfabriks A.-B., Malmö, and at the same time the formation of a new company bearing the same title with a capital of 1·5 million kr. The Barnängens Kemiska Fabriker in Stockholm and Hudiksvall has also failed, but work is to be continued. The projected absorption by Lever Bros., Ltd. of various Swedish soap factories may be regarded as definitely abandoned, but the formation of a combine within the country which will command about 90 per cent. of the entire production will be shortly effected. Companies producing superphosphate, paper, sulphite pulp, and iron ore have announced a partial or total suspension of operations. Unemployment is greater than during the early part of last year.—(*Chem. Ind., Mar.* 18, *Apr.* 11, 1921.)

The Soap Industry in Argentina.—In 1910 there were 200 soap factories in Argentina, having a total capital of £219,214, with an output valued at £602,860, and utilising imported raw materials worth £114,789. Since then the demand for soap has increased, production has risen, and importations have declined from 1795 metric tons in 1913 to 1371 t. in 1919. Hard yellow soaps are mainly produced as they are in greatest demand, but their quality is poor. With the exception of animal fats, all the raw materials are imported. In 1919 the United States supplied nearly all the rosin, nearly one-fifth of the soda ash, over 70 per cent. of the caustic soda, and about 5 per cent. of the sodium silicate. American silicate of soda has been criticised on grounds of quality and price, and the European product is preferred. The total importations in 1919 were:—Rosin, 15,503 metric tons; soda ash, 3459 t.; sodium carbonate, 1570 t.; Solvay soda, 5878 t.; caustic soda, 6543 t.; and sodium silicate, 4512 t. There is a steady demand for coconut and palm oils, perfumes, and colouring matters.—(*U.S. Com. Rep., Feb.* 18, 1921.)

The Phosphate Industry in Curacao.—According to *De Telegraaf* of March 8, the position of phosphate mining in Curacao is favourable, despite the emigration of a number of miners to Cuba. During 1920 64,969 tons was exported, distributed as follows:—Sweden, 28,505 metric t.; Germany, 15,758 t.; Holland, 10,566 t.; Spain, 2946 t.; England, 2113 t.; and Norway, 508 t. Exports during previous years were:—1915, 31,308 t.; 1916, 14,468 t.; 1917, 3582 t.; 1918, nil; and 1919, 19052 t.—(*Official.*)

REVIEWS.

Application of Dyestuffs to Textiles, Paper, Leather and Other Materials. *By* J. Merritt Matthews. *Pp.* vi.+768. (*New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.* 1920.) *Price* 10 *dollars.*

English readers have had abundant opportunity during recent years of becoming familiar with American publications on technical subjects, and will find that the present volume displays most of the points of excellence which they have learned to expect. The book is admirably bound, printed, and illustrated, but the text does not approach the standard of those English works on the subject with which it challenges comparison. The major portion of the work deals with textiles and includes sections on the chemistry of the textile fibres and the processes of scouring, bleaching and the like, as well as of dyeing. The treatment of these subjects is such as to form a suitable groundwork of instruction for pupils in technical schools. Each chapter concludes with an account of experiments which are very well devised for illustrating and impressing on the minds of students the points dealt with in the earlier part of the chapter, and the whole collection of experiments would form an admirable laboratory guide in the study of the subject. The arrangement of subjects in the text is such as to involve frequent repetition of the same statements, although with a different lay-out of the subject matter considerable space could have been saved. The details of works practice and the special precautions to be taken in work on a large scale are very inadequately treated. This is the more to be regretted because the book contains more numerous and excellent illustrations of machinery than the writer remembers having seen in a work on this subject. These illustrations, however, are for the most part not referred to in the text, and many of them are quite outside the scope of the work. Regarded as a text-book for students, the book appears to be rather too dogmatic and too little suggestive and stimulating to thought. The author is disposed to give explanations which strike one as merely facile. Such explanations may have some value as mnemonics, but it is doubtful if they are calculated to encourage a scientific habit of mind or lead to a sound knowledge of the subject. The treatment of such subjects as the application of sulphur colours and of mordant dyes on silk leaves a general impression that the dyeing industry in America has not reached so advanced a stage as in this country.

The book contains some useful summaries of the special properties of dyestuffs, and much information which can be found elsewhere only in a scattered form is here collected together very conveniently for reference. There is a copious bibliography.

In conclusion, this book can be recommended as a useful addition to technical libraries on account of its excellent illustrations and summaries as well as for the admirably devised series of illustrative experiments.

Benjamin Leech.

Water Purification Plants and their Operation.

By Milton F. Stein. *Second edition. Pp.* 270. (*New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.* 1919.) *Price* 16*s*. 6*d*. *net*.

The second edition of this book has recently appeared, and contains new chapters on bacteriological tests for water and their interpretation.

The fact that the book deals almost exclusively with American waterworks, where the problems to be faced are to a great extent different from our own, very considerably curtails its usefulness in this country, and the further fact that the chapters on chemical and bacteriological tests and their interpretation are written by an engineer for nontechnical men is also a decided disadvantage. It certainly does not seem wise that the chemical and bacteriological tests of such an important commodity as drinking water should be entrusted to anyone but a trained chemist or bacteriologist, and only a sanitarian should have the duty of interpreting them. The risk involved is too great; an error in carrying out the tests or a faulty interpretation of the results might open the way to very considerable trouble. Apart from this general principle, the author's treatment of this part of the subject leaves much to be desired. No mention is made in the chemical tests of any test for organic impurity such as free and albuminoid ammonia, or oxygen absorbed from permanganate, which are still insisted on by English sanitarians, and which are undoubtedly of great value when properly interpreted. The bacteriological tests given are also somewhat crude, although, as in the chapter on chemical tests, elaborate details are given of the apparatus required. The tests consist of the gelatin and agar counts and the litmus-lactose-agar, and lactose-broth tests for intestinal microbes. The latter tests would include many non-intestinal microbes, and to this extent err on the side of safety, but to the scientific mind something more exact would be preferable. A word may here be said on the difference between English and American standards. The Americans seem to be content with a standard based on percentage reduction, whilst in this country an absolute standard is generally insisted upon. Thus, if the raw water contained, say, *B. coli* in 0·001 c.c., and in the finally purified effluent this was reduced to a positive result with 1 c.c., they would call this a 99·9% reduction and be satisfied with it, but in this country we are not completely satisfied with sending water into consumption even with *B. coli* in 100 c.c.

This review has dealt chiefly with the chemical and bacteriological parts of the book, as they would seem to be those of most interest to members of the Society of Chemical Industry, and to that extent is adverse criticism: but much of the book is excellent.

Following an introductory chapter on sources of supply, a long chapter is devoted to detailed engineering descriptions of typical plants in the United States, covering all methods of purification. After the chapters on chemical and bacteriological tests, coagulation and sterilisation are carefully dealt with. The theory of coagulation and the chemical reactions of the coagulants are discussed, and numerous plants for the addition of chemicals are described. Then follow interesting chapters on water-softening, sedimentation, filtration, and general operation, and some graphic charts for calculating quantities of coagulants, etc. required under diverse conditions. These, by the way, are drawn for U.S. gallons, which are smaller than the imperial gallon.

The book concludes with appendices dealing with the analysis of coagulants, instructions for making standard solutions, and specifications for certain chemicals. It is profusely illustrated with sketches, photographs and working drawings, and is written in a clear and readable style.

D. B. Byles.

Rubber, Resins, Paints and Varnishes.

By R. S. Morrell *and* A. de Waele. *Industrial Chemistry Series, edited by* S. Rideal. *Pp. xii*+236, *with* 33 *figures in the text.* (*London: Baillière, Tindall and Cox.* 1921.) *Price* 12*s*. 6*d*. *net*.

This is yet another of the voluminous stream of recently published books belonging to what one is tempted to classify as the "Science-in-a-Hurry" type; books which, unfortunately, bear the obvious marks of hasty compilation and of lack of the care which is to be expected in scientific text-books.

The first part of this book deals with rubber, and occupies only 34 pages. Even allowing for unavoidable defects due to the extreme brevity of this section, one is compelled to state that it is lacking in accuracy and that the information given is not so well selected or arranged as it might have been. Considering the great importance of rubber both from the scientific and technical points of view, it is perfectly obvious that nothing adequate could have been written in so small a space, and that this subject should have been given a volume to itself. The remaining sections of the book dealing with drying-oils, resins and pitches, pigments and paints (including linoleum), and varnishes, are more satisfactory, though at times lacking in discrimination of the relative importance of the different subjects dealt with. Thus, it is difficult to understand why, in an elementary industrial handbook, more than six pages are devoted to the analysis of varnish (a complex subject which is obviously dangerous ground to the student), whereas less than three pages are given to the analysis of oils, and paint-analysis does not appear to be even mentioned.

This volume, in common with others of the series, is apparently intended largely for the advanced student, and it will certainly be of some value to readers requiring to obtain with a minimum expenditure of time and labour a general idea of the subjects dealt with. It is, perhaps, open to discussion whether such books are not somewhat dangerous to the student, as being calculated to lead him to accept short-cuts and easy paths to knowledge when he ought to be learning how to consult standard books and original papers. One must, however, admit that the authors have made some allowance for this in giving a short but useful bibliography of the subjects and fairly frequent references to journals, etc.

The reading of this book (particularly the first part) brings to notice a too-frequent fault in chemical and technical literature, *i.e.*, the misquotation and mis-spelling of botanical names; there is no more excuse for these faults than there is for errors in chemical formulæ. Authors and publishers would do well to attempt to obtain accuracy in botanical nomenclature.

Russell G. Pelly.

Journal of Indian Industries and Labour. *Vol. I., Part* 1. *February,* 1921. (*Calcutta: Superintendent, Government Printing, India.* 1921.) *Price Rs.* 1–8 *per part, or Rs.*4–8 *per volume of* 4 *parts.*

The publication by the Government of India of a new journal devoted to Indian industries and labour is further evidence of the increased attention which industrial development is now receiving in that country. In a "Foreword," Sir Thomas Holland explains that the Journal has been established to function as a bond of union between those responsible for the machinery of development in the different provinces of India in which policy and natural resources may also be different. At the same time it is also intended to act as "a medium for communicating to a wider public, within and outside India, information that will assist private enterprise."

To the number under review Sir C. E. Low contributes a particularly interesting article on "Possibilities of Industrial Development in the Central Provinces and Berar." Although chiefly concerned with the future outlook for these territories, many of the difficulties and problems dealt with may be taken as affecting the industrial development of India in general. Mr. B. M. Das, writing on "Researches in Tanning and the Calcutta Research Tannery," describes the organisation and objects of an institution which should do much to place this industry, of so great importance to India, on a sound scientific basis. Dr. J. Coggin Brown's "Trade Notes on Bauxite," whilst applicable more particularly to Indian conditions, are also of general value. Mr. S. T. Gadre describes the results of an investigation on "Clove Oil from Clove Stems," and discusses the possibility of carrying out the process of extraction on a commercial scale in India. An article by Capt. G. N. Frankau on "The Gilt Wire and Tinsel Industry at Burhanpur" affords an illustration of an old industry, by no means the only example in India, which has fallen into decay chiefly through the antipathy of the worker to adopt machinery and modern methods and thus meet European competition. Papers dealing with "Welfare Work in Bombay Cotton Mills," "Trade Disputes in Bengal," and "Industrial Education in Madras Presidency" are all of interest as serving to show that the development of industry in the East has given rise to problems similar to those which are still occupying the attention of the Western world. The Journal also contains a useful summary of Industrial Intelligence from the various districts and some Miscellaneous Notes.

In addition to the Journal, the Government of India announces the publication of Bulletins of Indian Industries and Labour, uniform in size with the Journal, and intended to deal with specialised subjects in monograph form.

It may be confidently predicted that if the high standard set by the first number of this Journal is maintained, the objects of its publication as set out therein will be fully achieved.

A. Rule.

OBITUARY.

A. WYNTER BLYTH.

Alexander Wynter Blyth was educated at King's College, London, and practised as a physician for a few years in Worcester before he became Medical Officer of Health and Public Analyst for the County of Devon. From Devonshire he came to London and filled a similar position to the Borough of St. Marylebone. Associated for many years with the Sanitary Institute, he served on its Council, was chairman of its judges, and latterly hon. registrar. A past-president of the Society of Medical Officers of Health, he was for some years editor of "Public Health," and had much to do with the foundation of that journal. He contributed papers on sanitary science, law (he was also a barrister-at-law), and the chemistry of foods and drugs to the learned societies, and was the author of two well-known books, "Foods: their Composition and Analysis," and "Poisons, their Effect and Detection."

Wynter Blyth died on April 1 last in his seventy-seventh year.

PUBLICATIONS RECEIVED.

Technical Records of Explosives Supply. 1915—1918. No. 1, Denitration of Spent Acids. *Ministry of Munitions and Department of Scientific and Industrial Research.* (*London: H.M. Stationery Office.* 1920.) *Price* 12*s.* 6*d.*

Relativity and the Electron Theory. *By* E. Cunningham. *Second edition. Monographs on Physics, edited by* Sir J. J. Thomson *and* Prof. F. Horton. *Pp.* 148. (*London: Longmans, Green and Co.* 1921.) *Price* 10*s.* 6*d.*

Thermodynamics and Chemistry. *By* F. H. McDougall. *Pp.* 391. (*New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.* 1921.) *Price* 30*s.*

The Formation of Colloids. *By* The Svedburg. *Monographs on the Physics and Chemistry of Colloids. Pp.* 127. (*London: J. and A. Churchill.* 1921.) *Price* 7*s.* 6*d.*

Critical Microscopy. *By* A. C. Coles. *Pp.* 100. (*London: J. and A. Churchill.* 1921.) *Price* 7*s.* 6*d.*

Sand-Lime and other Concrete Bricks. *By* H. O. Weller. *Building Research Board, Special Report No.* 1. *Department of Scientific and Industrial Research.* (*London: H.M. Stationery Office.* 1921.) *Price* 3*d.*

The Winning, Preparation, and Use of Peat in Ireland. Reports and Other Documents. *Fuel Research Board. Department of Scientific and Industrial Research.* (*London: H.M. Stationery Office.* 1921.) *Price* 3*s. net.*

Publications of the United States Geological Survey. *Department of the Interior.* (*Washington: Government Printing Office.* 1921.):—

Tungsten in 1918. *By* F. L. Hess.

Salt, Bromine, and Calcium Chloride in 1919. *By* H. Insley.

Mica in 1919. *By* H. Insley.

Coal in 1918. *Part B. Distribution and Consumption. By* C. E. Lesher.

Analytische Chemie. *By* Dr. Th. Dorino. *Wissenschaftliche Forschungsberichte, Naturwissenschaftliche Reihe, edited by* R. E. Liesegang. *Pp.* 97. (*Dresden and Leipzig: Theodor Steinkopff.* 1921.) *Price* 3*s.* 5*d.*

POST-GRADUATE TRAINING IN INDUSTRIAL CHEMISTRY.*

FRANCIS H. CARR.

In recent discussions concerning the training of chemical students for industry there is to be traced a unanimity of opinion as to the need of modifying or extending existing courses of instruction, at least so far as concerns the education of certain classes of chemists required in the industries, especially the fine chemical industries. Notwithstanding this, it seems that too little is being done to bring about the necessary changes. The difficulty of finding the money required for equipment and endowment is illustrated in the case of the Department of Chemical Technology of the Imperial College of Science and Technology. In my humble opinion this college needs an expenditure of several hundred thousand pounds in order that the Department may properly fulfil its great national purpose. The difficulty of getting money does not lessen the need of it, but imposes upon those in whom the war has awakened the full realisation of our shortcomings the serious duty of explaining our needs.

A strong alliance between the universities and the industries is now regarded by all as advantageous to both. The industries have in the past undervalued the importance of the part which the universities play in the fulfilment of the national purpose, by aiding the development and progress of industry. The universities depend largely upon the demand for training created by industry, and a little thought must convince all that even the pursuit of pure research must ultimately depend upon the value of its results to the physical, mental or moral well-being of humanity. On the other hand, the future development of industry lies with the trained and selected men from the university, and in the special case of the chemical industry, much depends upon the work done by the university in giving the right direction to science students, and providing the right training for each type.

If a discussion becomes discursive, it is apt to prove barren; I will make, therefore, a few hypothetical assumptions and rule these out of the discussion. The first of these assumptions relates to the curriculum for graduation in science; although I would like to see this modified in minor details, let us assume for the moment that it constitutes the desired foundation for those taking up a career in chemical technology. Secondly, let us assume that a three years' course with chemistry as the principal subject does not qualify a man in technical chemistry. It is regrettable that there should be a general feeling abroad, especially among parents, that graduation, which normally occurs in the third year, implies fitness for practice. A student has to work hard enough in all conscience during his three years in order to merit a first-class B.Sc., without spending any time upon the cognate subjects required to qualify him as a technical chemist. It becomes, therefore, a question of post-graduate training. Do we need the colleges to undertake this?

There are those who hold that since some firms are willing and able, and indeed prefer, to train their own men, there is consequently no need for intra-mural training in chemical technology. My comment upon this is that there are only a few firms fitted to undertake this work, and these few certainly are not willing to train men for the many other firms who cannot undertake to do so; and it is these unfitted firms which offer the greatest scope to the young technical chemist. The number of young chemists who are fortunate enough to gain admission to the works in which good training may be found is insufficient for a rapidly-developing industry, and even these men would gain much by attending a properly constituted course prior to the works training referred to. It is not all, or even most, of the chemists employed in works who need a special technological training, and only a small proportion of those who adopt chemistry as a career have the real instincts of the chemical technologist. Chemists not possessing this instinct may excel as workers in one or other of the works' laboratories, whether it be in that concerned with process-control, research or analysis. The technical chemist needs other qualities, such as ability to give directions when a reaction takes a course different from that expected, ability to accumulate experience of practical detail, to make yields higher and higher, to reduce the cost of labour more and more, and carefully to harvest from daily observation all those deductions which become summarised in a perfected process. Such power of controlling complicated and delicate processes, not merely conscientiously, but with intelligence and initiative, of observing closely and appreciating what in a mass of observed details is of practical importance, demands qualities of mind which are different from, though not incompatible with, those of the research chemist, although both types usually excel in the laboratory. These qualities are inbred, you will tell me, and are not produced by education. True enough; but the development of these qualities may be enormously helped by a training in certain subjects not gained during a three-years' course, or during the longest sojourn in a research laboratory. The industrial chemist may have the research instinct, and he will not need to starve it, but his hunger after new knowledge for its own sake must not prevent him from giving his interest and great enthusiasm to minute questions of economy, to the choice of the cheapest materials, to labour-saving devices, thermodynamic considerations, questions of fuel economy, and so forth. Such work demands not merely a type of ability as specialised as that of the research chemist, but, above all, a specialised type of training which it is our business now to consider.

In speaking of the technical or industrial chemist, I have in mind, perhaps, a more particular type of man than the actual expression implies, namely, the person who gets to grips with the actual chemical or industrial process carried out on the large scale; in this country the heavy chemical and metallurgical industries, as well as those concerned with the production of fats, oils, soaps, starch, sugar, tanning, etc., have on the whole been moderately well developed, and have in many respects even excelled. In the synthetic organic chemical industries, on the other hand, the elaboration of residuals, the manufacture of intermediates, dyes, photographic chemicals, drugs and the like, have not, prior to the war, succeeded, and we have been outstripped by foreign competitors. I think we may find in this distinction some indication as to the line we should pursue in education in order to remedy the latter condition. In the organic chemical industries there is a great diversity of operations involving expert knowledge; frequently the demand for the product concerned is on such a scale that its manufacture cannot be carried on continuously all the year round, so that the diversity of functions required for individual manufactures—much more complicated than in the case of the first-mentioned class of substances—is still further extended by the making of now one compound and now quite a different one. The operations require a very close attention to details, and quite small variations of conditions may entail great reduction of yield and result in financial losses. Now, those responsible for the supervision of such work must not only be skilled, but highly educated men of a particular type who, when produced in this country, hitherto have been self-trained and not the direct product of the university; but I suggest that it is not only possible, but of urgent importance that we should give a suitable training for this purpose. It is true that the right men are few, and it therefore takes a big net to catch them. It would surely be of immense advantage if students admitted to any such post-graduate course in a college were graduates widely drawn from the various universities of the country. Such moving about might with great advantage be encouraged more than it is.

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* Paper read before the Old Students' Association of the Royal College of Science, Feb. 8, 1921.

Chemists in the heavier industries referred to above can in a large measure carry on their work from the laboratory and the office, giving instructions to the foreman whose rule-of-thumb knowledge constitues a very real bulwark, but in the manufacture of fine chemicals processes need to be directed by a chemist on the spot. This chemist must be a man who inspires confidence, and can act with courage born of conviction. A man who not only knows, but who knows that he knows, and, above all, a man willing to don overalls and to dignify his works and himself by practical co-operation on the plant.

If you will take the view that for such positions men can, by training, become better fitted for the work earlier in life, what is the nature of the training required? A sound fundamental knowledge of chemistry, physics and mathematics is a condition of graduation; super-added to this must be a not inconsiderable training in engineering, machine construction and machine drawing; together with knowledge of fuel economy, chemical kinetics, thermochemistry and electrochemistry, works management, costing and accountancy, and chemical economics. By the last-mentioned, I mean a study of the efficiency of established processes, *e.g.*, alkali, acid and explosives manufacture, and nitrogen fixation from a point of view well illustrated in the Government publications relating to the achievements in war factories during the war. The historical review of these processes would constitute an admirable basis for a course of study. These may be treated as classroom subjects, but they cannot be effectively studied without very special practical training in a technical-chemical laboratory. Such a laboratory would preferably be nothing less than a manufacturing undertaking, but it would not deal with specific manufactures, such as sulphuric acid or soap or brewing or dyeing, as these may be regarded as the function of trade schools which are able to undertake useful teaching of a different kind.

I wish particularly to emphasise the point that there are special underlying principles relating to the application of chemical science to manufacture which can be taught and be of excellent educational value. It may be argued that a one-year's curriculum is all that is absolutely essential, but to this I am not personally inclined to agree; however, the courses might conceivably be so arranged as to leave the way open for some students to break off at the end of the first year, while others spend a second year at laboratory work. I believe, however, that a second year would prove of inestimable value and be readily adopted by students.

In addition to the general classroom subjects referred to, I would make provision for courses of lectures and reading on groups of chemical subjects somewhat as follows:—

(1) Dyestuffs, synthetic drugs, essential oils, sugars, alkaloids, biochemistry;

(2) Coal tar, petroleum, fatty oils, alkali, and acid;

(3) Colloid chemistry, rubber, tanning, cellulose; students being expected to take at least one of these courses.

The success of all attempts to teach chemical technology will depend, however, chiefly upon the opportunity to put knowledge into practice in the laboratory, to develop initiative, resource, and self-reliance in dealing with processes, and in translating laboratory experiments to works-scale manufacture. Often does it happen that a chemist believes a foreman's method to be capable of improvement, yet he has not the varied experience which will justify him in interference, and thus his initiative is discouraged and suppressed. It must be remembered that the majority of foremen secretly resent improvements introduced by another, and will even resort to trickery to render unsuccessful any modification of process suggested by a chemist.

Now, manufacture cannot well be carried on in the laboratory unless the goods manufactured are going to be made use of in one way or another. There are both psychological and practical reasons for this. Materials must be used, and the cost of them, unless the finished product be sold, is a serious deterrent to free experiment; further, a student is not satisfied to expend care on producing a substance which will be wasted and will not come before the tribunal of public criticism; nor would it be good for him if he could be induced to work regardless of these factors.

The scheme advocated consequently involves the formation of a technological teaching laboratory of a new type, one which would be a miniature manufacturing establishment associated with a college providing the necessary lectures and class-room instruction.

In addition to chemical manufacture, technical-scale experiments extending the results of investigations in research institutions or elsewhere might well be undertaken; one would expect that there are enough small demands for compounds not supplied in the ordinary way of trade, as well as for these technical scale experiments, to keep such a college laboratory perpetually engaged in useful work. The compounds manufactured would include such of the less common compounds of rare application as the manufacturer will not be troubled to supply, because the demand is too small and irregular. This manufacturing laboratory would need a permanent staff of experienced men who would act as demonstrators and take a personal part in the practical work. The laboratory would need to be run under conditions of strict and complete business organisation and discipline, with long hours of attendance. Powers practically equivalent to that of dismissal would be entrusted to those in control, and no student would be permitted to proceed from one stage in his course to another without having qualified in the earlier one.

1. Structurally the laboratories would consist preferably of a lofty shed about 27 ft. high, of steel construction, well lit and ventilated, the steel being arranged so that staging may be erected at 9 ft. and 18 ft. from the floor, in which technical-scale plant can be rapidly erected. The successful use of this laboratory would in large measure depend upon the provision of standardised pans, covers, columns, and stills, which can be rapidly fixed in position, such engineering work being chiefly carried out by students

This laboratory might well contain a few special plants designed for typical manufactures suitable for determining efficiency on short runs, such, for instance, as nitro-toluene, formaldehyde, phosgene, ammonia oxidation, benzoic and salicylic acid, the products from which would be utilised for further processes.

2. A large kitchen laboratory fitted with small apparatus of 50 to 100 litres capacity, including typical centrifugal filtration and evaporation plant,

autoclaves, hydraulic press, and so forth. This building should also preferably be a single storey building, and contain a good laboratory for investigations of a preliminary character.

3. The drawing office, library and administrative offices, stores, and the analytical and physical laboratories, each separate rooms, might be included under one roof.

4. The workshops—wood and iron—foundry and forge, and plumbing shop would constitute another departmental group of buildings.

5. A power plant, generating steam, gas, and electricity under conditions which enable a daily computation to be made of the efficiency of each is an essential adjunct. The steam, gas, and electricity would be distributed to separate sections under a scheme of meters to enable the various operations to be accurately assessed with the consumption.

The fundamental object of the instruction would be to introduce the cost quantity in relation to power, heat, labour, cost of material, and yield of product. The observance of these principles concerns the chemical industry more especially than any other, because in that industry costs may vary over an enormous range according to the care and skill exercised. To assist the student in this attitude I consider instruction in practical accountancy, costing, and stock-keeping to be of fundamental and first importance. The care, initiative, and resource which need to be exercised, the practice in approaching problems on economic lines, and the practical knowledge gained, combined would constitute an admirable preparation for industrial management in many spheres, by no means confined to organic chemicals.

During the first year the student would attend courses of instruction in physical and electrochemistry, construction, and design, chemical engineering, and machine drawing. He would also receive practical instruction in the workshops, power-house, analytical laboratory, administrative office, and in the use of special machinery and plant. He would take his turn at stoking, engine driving, plant erection, lead-burning, the making of steam joints, and so forth.

Passing into the works laboratory, first-year students would at first manufacture simple compounds, and be given an opportunity of assisting the operations of advanced students. These manufactures would need to be conducted under strict discipline as regards both time spent and quantitative results, and although from its nature the work would not be on the full scale of ordinary technical procedure, it would be carried out on a sufficiently large scale to require manufacturing apparatus as distinguished from that of the laboratory. During the first and second year the student would become gradually familiar with the construction and use of autoclaves, large reaction vessels, vacuum pans, gas compressors, furnaces, centrifuges, and filter presses, and would acquire experience in handling difficult substances, in utilising catalysts, etc. He would also have experience in designing special pieces of plant for particular technical processes. The courses of lectures would include steam-raising and power production, every student spending several weeks in the department concerned with the supply of steam and power to the institution, and in a laboratory in which fuel, water and flue gases, etc. are analysed. Courses of instruction in special manufactures, such as sulphuric acid and alkali, as already stated, would probably find their places in the curriculum; arrangements might be made for students destined for particular industries to attend special courses of instruction given by men actually engaged in the industries in question—a proceeding which has already been adopted in the evening classes of some of our technical colleges.

Further, it would be an invaluable adjunct to such a college if arrangements could be made for students to attend courses of practical instruction in actual works. By careful arrangement this might be done with such slight interference to the business of the firms concerned during only a short period in each year, that the opposition to receiving such visitations would be satisfactorily met. Above all, it is essential that the staff of the college should consist mainly of men of ripened works experience—not, be it understood, men (however able) who have merely spent a period in the research or analytical department of a works. Such men have usually been regarded by our educational authorities as men with works experience, when in point of fact often they have little or no real claim to a knowledge of chemical manufacture.

As regards the nature of the substances manufactured, the first-year students might be occupied partly in making from the raw material simple inorganic and organic substances; for instance, potassium dichromate and permanganate, metallic arsenic and tellurium, hydrogen peroxide, hydriodic acid, ammonium persulphate, nitrations, sulphonations and the like organic operations, and partly in isolating and purifying tar products, sugars, and natural vegetable products, such as theobromine and caffeine.

In the second and succeeding years—for it may safely be assumed that many students would remain even longer than two years, and it should prove possible to pay them to do so—the students would be occupied chiefly in carrying out large-scale technical research; they would be enabled to follow each other's processes, being present to watch critical stages. The compounds manufactured would, in general, be those which, while not in common use, are required for exceptional purposes, chiefly by colleges and research laboratories. In order that the scale may be a large one it would be necessary to make of many substances much bigger quantities than are likely to be required; these might remain in storage for many years, and only gradually would a complete list of substances in demand be accumulated.

One claim for this scheme is that, besides affording a really practical training, it would maintain and impart by means of actual manufacture and sales a standard of industrial efficiency almost impossible of attainment without this incentive. It would also have the practical value of supplying many chemicals for which we were formerly dependent upon Germany. Nor need we fear that such a scheme would give serious offence in commercial quarters, for the monetary value of business in the manufacture of fine chemicals of this type is of no great account, and it would not be difficult to avoid jealousies by confining the manufacture to those substances which manufacturers of fine chemicals do not wish to produce, and by rigorously adhering to a scheme of distribution through existing trade channels. If a manufacturer should complain that he is subjected to unfair competition through the production of a certain chemical by an endowed and privileged institution, the reply is simple: Let him produce a supply of the substance of adequate purity, and it may be assumed that the college of my conception would leave it to him.

Incidentally, the college would prove of great advantage to research workers, who would have here facilities for procuring the compounds with which their investigation commences, instead of spending much of their valuable time in repeating tedious preparations on a small scale. This single benefit, increasing as it would the effectiveness of research workers, would react favourably on the industry as a whole.

It may be objected that the student cannot lengthen his course at college by a further period of two years. A medical student does not become qualified in less than five years. Why should a chemical technologist expect to do so? I venture to think he would have to apply himself just as strenuously to achieve what is required of him in the time. The two years would be spent much more effectively from the point of view of increasing the student's monetary value than any other two years of his education, and so far as many are concerned, more profitably than if spent on research.

As to the financial aspect of the scheme, it may be agreed that as manufacturers would gain much they should be looked to for assistance. With chemical industry threatened as it is at this moment, one hardly dare look for much help in this quarter; nevertheless, one might confidently expect that when successfully established the fine chemical industry would afford a substantial contribution towards the maintenance, but the equipment must be costly and the buildings substantial. Surely for this we must look to the Government, whose duty it is to direct our educational organisation with a greater bias to practical ends. Enough to build and endow such a college many times over would have been saved during the war from the vast expenditure on chemical war factories had we had the foresight to establish the fine chemical industries here previously, and a dozen students from a college such as that which I have endeavoured to conjure to your minds might have saved millions. But these millions will only be truly lost if, failing to learn the lessons of the war, we allow our fine chemical industry to slide back to the condition in which it was when war commenced. We escaped disaster once; be sure we should not so escape again.

A BELGIAN BUREAU OF CHEMICAL STANDARDS *

Scientific and Technical Importance of Very Pure Chemical Substances.—It is well known that the purity of materials plays an important and often an indispensable part in many branches of science and technology. Thus the individuality of many chemical types can only be established by preparing very pure elements, and such work has lead to the discovery of numerous elements (*e.g.*, rare-earth elements, rare atmospheric gases) and of entirely new classes of compounds (thiophen an impurity in benzene). Certain physical properties can only be determined by employing pure substances (super-conductivity of metals in liquid helium), and others are inseparably associated with the presence of certain definite impurities (phosphorescence). The progress of stoichiometry depends above all on the investigation of the constants of chemically pure substances. In metrology there is a tendency to replace the use of standardised instruments (metre scale, standard thermometer, etc.) by the adoption of selected constants of well-defined substances. The use of very pure products has also become equally indispensable in technical work, for example, for analytical reagents and the fundamental constants of alcoholometry (density of absolute alcohol); electrolytic copper; pure gases in large-scale catalytic processes; and in biology and medicine, the use of very pure chloroform as an anæsthetic, and of very pure sugars for certain bacteriological cultures.

How can they be obtained?—Both chemists and physicists are often held up in their work by difficulties in obtaining specimens of very pure materials essential to their investigations. Except in special cases, sufficiently pure substances cannot be purchased, whilst those obtainable have to be purified and their purity established. But the purification of small quantities of substances is often very difficult and the criteria of purity are not sufficiently sensitive; the preparation of larger quantities would save much trouble, *e.g.*, in the case of mixtures of isomers or homologues. All physical chemists know, for example, the great amount of work entailed by every worker having to prepare such a substance as pure normal pentane. The war, finally, has much increased these difficulties by diminishing the availability of materials required in the preparation of pure substances.

Such considerations as these have been occupying the minds of chemists in the United States and Germany, even during the war, and have led them to take steps to fill in the *lacunæ* and thus make their work easier, more expeditious and more fruitful.

What has been done in the United States and in Germany.—The Physikalisch-Technisches Reichsanstalt at Charlottenburg has undertaken to make "normal" metals available to German chemists. Research has shown that metals sold as "pure" frequently contain more than 1 per cent. impurity; that it is impossible to prepare on an industrial scale, and without undue trouble, specimens containing less than 0·01 per cent. impurity; and that such substances—classed as grade 4†—suffice for the determination of atomic weights. The Reichsanstalt has therefore initiated a series of researches with the object of determining industrial processes of purification and methods of analytical control. Once these have been worked out, the preparation is entrusted to an industrial firm under the control of the Reichsanstalt, and the specimens are sold with a guarantee of purity certified by it. Similar arrangements have been made with regard to mercurous sulphate (for the Weston cell).

In the United States an analogous task has been undertaken by the Bureau of Standards at Washington, which prepares and sells specimens of alloys and minerals of known composition for analytical control, pure metals for thermometric standards, and certain organic compounds of which the method of purification is minutely described: naphthalene and benzoic acid for calorimetric standards, ammonium oxalate and dextrose for analytical work, and cane sugar for polarimetry.

American chemists, on their side, have created an industry of pure organic products in order to be independent of Germany. The Pfanstiehl Company, for example, specialises in bacteriological sugars, and the Kodak Company either produces or distributes gratuitously more than 750 organic compounds. All these efforts are co-ordinated by the National Research Council, and the work already accomplished is very remarkable.

Plans of the Belgian Chemical Society.—The above examples have instigated the Société chimique de Belgique to undertake similar work by providing a collection of pure standard substances, to be located partly in the University of Brussels. At the conference of the International Union of Pure and Applied Chemistry held in Rome (July, 1920), the Belgian delegates MM. Lucion and Swarts presented a memorandum by M. Crismer detailing the reasons for establishing such a collection. In response, the conference decided to establish a Bureau of Chemical Standards and to entrust its organisation to Belgium. Already before the war the author had started a collection of pure organic liquids, and thanks to the help of M. Chavanne had received a grant from the Solvay International Chemical Institute which enabled him to collect a number of organic products to serve as starting material for the preparation of standards.

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* Translation, slightly abridged, of a paper presented by J. Timmermans to the Société Chimique de Belgique on January 30, 1921, and published in the Bulletin de la Société Chimique de Belgique, Vol. 30, 1921.

† The Reichsanstalt prescribes five grades of impurity, as follows:—Grade 1, containing from 1 to 10% of impurity; grade 2, from 0·1 to 1%; grade 3, from 0·01 to 0·1%; grade 4, from 0·001 to 0·01%; and grade 5, from 0·0001 to 0·001%.

The programme has been sketched out as follows:—

(1) It is proposed gradually to extend the existing collection until it contains samples of every well-defined chemical product, but in the first place efforts will be concentrated on, although not confined to, the collection of pure organic liquids, substances which are particularly difficult to obtain at the present time. The collection should therefore contain representatives of typical organic substances which can be preserved in a state of purity without too much difficulty. For this reason it is not proposed to keep esters which are readily hydrolysed, but only the acids and alcohols from which they are derived.

(2) It is intended to maintain a depôt of standard substances which have been prepared in the United States, or in any country adhering to the International Union, so that the results of the labours of American chemists may be made available to their colleagues in Europe.

(3) Small quantities of the standard substances will be placed at the disposal of Belgian and foreign scientists to save them the tedious work of re-purification. It will therefore be desirable that the samples shall be made from single batches of materials weighing several kilograms; and this will inevitably lock up considerable capital.

(4) The Bureau will act as a centre of information on all matters appertaining to pure products, rare specimens, and the relevant literature.

How to help the Bureau.—(1) To-day more than ever money is the nerve of action, and therefore all who appreciate the importance of the work are asked to aid in developing its financial resources. Such an undertaking far exceeds the power of any one man, but a relatively small endowment would suffice for the institution of research scholarships to enable the Bureau to obtain the necessary collaborators.

(2) Industrial firms will be free to make a substance once the method of preparation has been definitely established. The Bureau, content with its *rôle* of pioneer, will then be able to turn its attention to new preparations. It is hoped that the example set by the Kodak Company in America will be followed in Europe. Manufacturers, in their turn, will be able to render great assistance by supplying the necessary starting materials and raw products, so reducing the amount of capital locked up in the collection; in this way they would encourage scientific work of general interest.

(3) In conclusion, directors of laboratories can greatly assist their colleagues by placing at the disposal of the Bureau specimens of pure materials or rare substances which they have made in the course of their work and which may be useful as standards. If a director wished to retain the material himself, he could make known to others, by means of the Bureau, that his specimens were available; and exchanges could be effected that would be advantageous to all concerned. For a similar reason specialists in this sphere are asked to keep the Bureau informed of the progress of their work, in order that it may be made known to all interested in the subject.

With the help of Belgian and foreign chemists it is hoped to carry out this programme of work; and for this the memory of Stas, that pioneer of chemical standards, will act as a stimulus.

TURPENTINE IN THE UNITED STATES.

A recent bulletin by F. P. Veitch and V. E. Grotlisch (U.S. Dept. Agric., Bureau of Chem. Bulletin No. 898. 1920) contains much useful information on the production, marketing, and uses of turpentine in America. About 75 per cent. of the world's supply of turpentine is produced in the United States, chiefly from the southern longleaf yellow pine (*Pinus palustris*), but other species, such as the Cuban or slash pine (*P. caribœa* or *heterophylla*), the rosemary pine (a variety of the loblolly pine *P. tæda*) and the western yellow pine (*P. ponderosa*) are also tapped; most of the remaining 25 per cent. is obtained in the south-western coast regions of France from the maritime or cluster pine (*P. pinaster* or *maritima*). The relative production of turpentine in the various States of America is approximately as follows:—Florida, 37 per cent.; Georgia, 19 per cent.; Louisiana, 15 per cent.; Alabama, 12 per cent.; Mississippi, 9 per cent.; Texas, 7 per cent.; North and South Carolina, less than 1 per cent. Formerly North Carolina produced the bulk of the world's supply of turpentine. At present less than 10 per cent. of the total is wood turpentine obtained from stumps and deal or fallen timber by steam or destructive distillation; this source of turpentine is becoming more important.

The oleo-resin is obtained by scarifying or "chipping" the living trees. A V-shaped cut is made about once a week immediately above the last cut, thereby forming a "face," down which the gum exuding from the cut flows and collects in galvanised iron or baked clay cups holding 1 to 2 quarts. The tapping season lasts from early spring to late autumn, the oleo-resin being removed from the cups about once a month and taken to the still in barrels.

The distillation plant is simple and has not been improved materially during the last 50 to 60 years; it consists of a copper still of 500 to 1000 gallons capacity, with a still-head (generally removable) connected to a large copper condensing-coil cooled in water. From 7 to 14 barrels of oleo-resin go to make a charge, depending on the size of the still and the nature of the oleo-resin.

The oleo-resin contains some water, and the distillate at the commencement consists of about 45 per cent. of turpentine and 55 per cent. of water. When most of the water originally present has passed over, as shown by a decrease of the water contained in the distillate to about 30 per cent., and by the peculiar sound which is heard close to the tail-pipe of the condenser coil, a small stream of water is admitted to the still. The distillate is collected in a barrel in which it separates from water; it is desirable to cover the barrel to avoid loss by evaporation. The yield of turpentine varies from 16 to 22 per cent. The turpentine is mostly shipped in wooden casks holding 50 to 53 U.S. gallons (231 cb. in.). These barrels are treated internally with two coats of glue to prevent the turpentine from penetrating the wood; steel drums are used only to a slight extent, but the larger producers, especially in the more western States, employ tank-cars of 5 to 10 thousand gallons capacity. On arrival at the primary markets each barrel or tank-car is inspected, and the grade (colour), purity and freedom from water, and volume of the turpentine determined.

The total production in the U.S.A. for the 1919 season amounted to 366,000 casks (50 galls.) of turpentine and 1,237,000 barrels (500 lb.) of rosin; during 1920 up to August 1, 237,155 casks of turpentine and 712,387 barrels of rosin were produced, the estimated production for the rest of the season being

233,876 casks of turpentine and 739,679 barrels of rosin.

The bulletin gives details of the market customs prevailing in the U.S. turpentine trade, of the methods employed in gauging barrels and tank-cars, together with references to the laws governing the sale of turpentine in various States, and also quotes the specifications recommended for turpentine by the U.S. Inter-departmental Committee on Paint Specification Standardisation (Oct., 1919), with full details of the methods of sampling and analysis.

SOCIETY OF CHEMICAL INDUSTRY.

ANNUAL MEETING, 1921.

Accommodation on the s.s. "Melita."

Members and their friends who intend proceeding to Canada for the meeting, and who have decided to travel with the President and his party on the "Melita" (not the "Megantic," as inadvertently stated in the last issue), are requested to secure their berths with the least possible delay. The offices of the C.P.O.S. are: Pierhead, Liverpool; 62-65, Charing Cross, Trafalgar Square, S.W. 1; and 103, Leadenhall Street, E.C. 3; at any one of which arrangements may be made.

Return Sailings from Montreal.

For the information of those who desire to return *viâ* Montreal, the following sailings of C.P.O.S. steamers are given:—

	First Class Minimum £ s.	Second Class Minimum £ s.
Sept. 10. Empress of Britain	51 10	.. 31 10
Sept. 16. Victorian	—	.. 30 0
Sept. 20. Metagama	—	.. 32 10
Sept. 23. Melita	—	.. 32 10
Sept. 24. Empress of France	51 10	.. 31 10
Sept. 30. Minnedosa	—	.. 32 10

"Empress" steamers sail from Quebec only, but free railway tickets will be provided between Montreal and Quebec. All other steamers carry "cabin" class only from Montreal. Members and their friends who wish to return home by one of these boats should communicate with the C.P.O.S. before the end of June, and the company will arrange for reserved accommodation.

Passport Regulations.

The following information regarding passport regulations should be noted: Passengers travelling to the United States *viâ* Canada and passengers proceeding to Canada *viâ* the United States must obtain the U.S. consular *visa* on their passports before they leave the United Kingdom. Passengers who are not U.S. citizens must make *personal application* for *visa* at the U.S. Consulate nearest their place of residence. One photograph of each passenger is required. Application should be made not less than two weeks prior to the date of sailing. Passengers travelling from the United Kingdom to the U.S. *viâ* Canada cannot obtain the American consular *visa* in Canada; it must be obtained in the United Kingdom prior to sailing. Forms and full information regarding procedure are obtainable at the Canadian Pacific offices.

U.S. Head Tax.—As required by the U.S. Government, all passengers (excepting U.S. citizens) proceeding to points in the United States must pay at the time of booking the head tax of £2 5s. per person in addition to the ocean fare; children under 16 years of age accompanying their father or their mother are exempt.

VISIT TO SHAWINIGAN.

Arrangements have been made to take the visiting members of the Society to Shawinigan Falls immediately after the conclusion of the Annual Meeting. A special train is being provided for members and their friends, which will leave Montreal at 11.30 p.m. and arrive at Shawinigan Falls next morning.

Shawinigan Falls owes its existence to the splendid electric-power development; prior to 1898 it was a forest wilderness, but the year following the Shawinigan Water and Power Co. installed two 5000 h.p. generators, which formed the nucleus of the present development of the district, now amounting to over 300,000 h.-p. It is estimated that the district has a potential capacity of over a million h.-p.; this power is the foundation of a group of chemical industries which compare favourably with any on the American continent using over 130,000 h.-p.

The pioneer chemical industry to be established was the Northern Aluminum Co., which started operations about 1901 and now uses ten times as many h.-p. as at that time. The principal raw material—bauxite—has not yet been discovered in Canada, but is imported from Arkansas. The process followed is the well-known Hall method of producing aluminium by direct current, using a bath of alumina in fused cryolite. In addition to manufacturing aluminium, the company also maintains a wire-drawing plant, and makes all the aluminium wires and cables used in Canada.

Following closely on the heels of the Aluminum Company, the Belgo-Canadian Pulp and Paper Co. started operations in 1903. This undertaking owns large timber areas on the St. Maurice River and its branches, down the streams of which the logs are floated to the mill. The company produces both ground-wood and chemical pulp, and in addition makes over 90 tons of paper per day.

The Canada Carbide Co. was established in 1903, the first installation being one small single-phase electric furnace. From this small beginning it has grown to such an extent that it now occupies some fifteen acres of land, upon which have been erected lime-kilns, buildings for storage, two main rooms where the carbide is produced in furnaces ranging from 3000 to 10,000 h.-p. The carbide is crushed, sorted and packed in separate rooms, and there is a small plant for manufacturing steel drums and wooden crates for shipping.

The Canadian Electro-Products Co. came into existence to supply the demand for acetone in cordite manufacture during the war. Production from calcium acetate obtained by wood distillation proved entirely inadequate and, at the request of the British Ministry of Munitions, the Shawinigan company started investigating the possibility of producing acetone synthetically from acetylene. The experimental work was begun in December, 1915, and after a half-year's intensive research by five Canadian chemists, construction was commenced in May, 1916. By January, 1917, the whole plant, covering fifteen acres, was complete, and the first car of acetone shipped to England. The working out of the process, of which the steps are carbide→acetylene→acetaldehyde→acetic acid→acetone, involved the development on a large scale of reactions hitherto only performed in the laboratory and which presented difficult and unusual problems; and it is very much to the credit of those concerned that when the plant was doubled at the entry of the United States into the war only a few minor changes were made in the design and arrangement of the equipment. The production exceeded 10,000 tons of acetic acid in 1918. Acetone is not manufactured at the present time; the process is stopped at the acetic-acid stage, 99 per cent. acetic acid being obtained in one distillation.

Plans are now being made to produce acetic anhydride, monochloracetic acid, aspirin, etc.

The Canadian Aloxite Co., a subsidiary of the Carborundum Co. of America, started about two years ago and is gradually increasing its operations, so that in the near future it will utilise 20,000 h.-p. The products are ferro-silicon and abrasives.

The demand for electrodes for the electric furnaces at Shawinigan Falls and Montreal led to the formation of the Canadian Electrode Co., which has a plant capable of meeting all the requirements of the locality. Only carbon electrodes are now made.

Rarely can one find in so restricted an aréa so many industries of which the life depends upon chemical research.

MEETING OF LEATHER CHEMISTS IN NEW YORK.

A letter has been received from Mr. J. A. Wilson, chairman of the Leather Chemistry Section of the American Chemical Society, extending a very cordial invitation to the leather chemists of this country to attend the sectional meetings in New York City during the week beginning September 5, 1921. It is anticipated that some very important papers will be read which will mark the beginning of a new and vigorous development of the chemistry and microscopy of leather manufacture. Papers in course of preparation relate to the microscopy of hide and leather at all stages of the process, the action of enzymes in bating, the chemistry of the tannins, chrome and vegetable tanning, and vegetable tannin analysis. British chemists are invited to contribute papers, and if they cannot attend the meeting they are asked to send them to Mr. Wilson (203, Juneau Avenue, New York) to reach him not later than August 6.

NEWS FROM THE SECTIONS.

NEWCASTLE.

A dinner was given by members of the Section on April 23, in the Central Station Hotel, in honour of the President of the Society. Dr. J. H. Paterson presided, and among those present were the Rt. Hon. the Lord Mayor of Newcastle, Mr. A. E. Doxford (chairman, N.E. Coast Institution of Engineers and Shipbuilders), Mr. G. Vardy (president, British Foundrymens' Association), Dr. J. P. Longstaff, Professors P. P. Bedson, Henry Louis and W. N. Haworth, Dr. J. T. Dunn, and Mr. E. Morley Fletcher.

Dr. Paterson, in proposing the toast of the Society, coupled with the name of the President, said that they were all proud of the Society, which was one of the most influential societies in the country, if not the largest numerically. They were proud of the Society's *Journal*, which was one of the most advanced and best-arranged journals in the world, and they were also proud of their President, whose work was known and appreciated far beyond the ranks of their own members. Sir William Pope said that he was fully confident that the future of the Society would be as glorious as its past. The criticisms that were occasionally heard really demonstrated that the Society was alive, and that progress was being made. He agreed with the chairman that the *Journal* was one of the foremost in the world. After alluding to the great part which the Newcastle Section had played in the success of the Society, and to its distinguished past-presidents, Sir William Pope spoke of the forthcoming annual meeting in Canada, and appealed to the Section, and to all the other Sections, to send as many members as possible to take part in it.

Prof. P. Phillips Bedson proposed the health of the Lord Mayor of Newcastle, Prof. H. Louis that of the guests, Dr. J. P. Longstaff that of Armstrong College, and Dr. F. C. Garrett that of the hon. local secretary and hon. treasurer. The chairman gave the health of Prof. Bedson, who has been a tower of strength to the Newcastle Section, and who is shortly to retire from the chair of chemistry at Armstrong College, after nearly 40 years' service.

At the annual meeting which preceded the dinner, the officers of the Section were re-elected, and the following were elected members of the committee, out of 18 nominations:—Messrs. P. E. Bowles, W. Diamond, J. T. Dunn, F. C. Garrett, F. Hirsch, D. W. Jones, H. Louis, H. Peile, A. Short, F. H. Walker, and G. Weyman.

BIRMINGHAM.

The annual meeting was held in the University buildings on April 14, Dr. H. W. Brownsdon presiding. There are no changes to report in the list of officers of the Section, but the following were elected to fill vacancies on the committee:—Messrs. W. Brazier, G. H. Blenkarn, F. L. W. Bradford, H. T. Pinnock, and W. C. Davis.

Dr. E. B. Maxted read a paper on "The Manufacture of Pure Hydrogen and the Catalytic Hydrogenation of Oils." In discussing the four methods by which hydrogen is now usually prepared for use in industrial catalytic processes, the author stated that the electrolytic and the cyclic water-gas processes gave sufficiently pure hydrogen for direct use, but the gas obtained by the low-temperature separation of the constituents of water gas and by the catalytic water-gas process required to be further purified from carbon monoxide. The cyclic water-gas method was particularly suitable for manufacturing hydrogen for the hardening of oils. Dr. Maxted then explained the origin of the small amount of carbon monoxide occurring in the hydrogen produced in the last-mentioned process, and pointed out that the deposition of carbon, which was the *bête noire* of this process, could be easily prevented by varying the composition of the gas used for reduction, viz., by using in place of ordinary water gas a gas somewhat richer in carbon dioxide, such as was obtained with a water-gas producer constructed for operating at an abnormally low temperature. In the hydrogenation of oils, it appeared that traces of oxygen or nitrogen acted principally as diluents, but in certain other catalytic reactions, traces of oxygen acted as an inhibitant, and it was then necessary to use water for generating the steam which was as free as possible from dissolved air. The *modus operandi* of hydrogenation was then outlined, and this was followed by remarks upon the nature and activity of the nickel catalyst, the influence of temperature and speed of reaction. In the hydrogenation of ordinary commercial oils, it was the author's practice to begin hardening at 120°—130° C. and to allow the temperature to rise to a maximum of about 160° C.

GLASGOW.

A paper on "Tar Distillation" was read by Mr. W. A. Walmsley, of the Glasgow Corporation Chemical Works, at a meeting held on March 22, Mr. J. H. Young presiding.

Crude tar is difficult to distil when any ammonia water remains in it; an actual charge of 30 tons in a pot still requires 22 hours for the removal of water and crude naphtha, and only 6 hours further to complete the distillation to pitch. Modern stills are designed to obviate this long period of distillation of water and naphtha, and at the same time to economise fuel. The vapours from the stills are passed through coils covered by crude tar in a pre-heater, whereby they are cooled and the crude tar is dehydrated. A further development of this principle is found in the continuous tar-distillation plant. Incoming tar is gradually warmed by meeting outgoing vapours, and in passing through a series of stills is stripped of fraction after fraction until pitch only is left. The system is not elastic enough in its present form.

Dehydration by pumping crude tar through heated coils and releasing suddenly to atmospheric pressure is being successfully accomplished, and the same system is used in working up crude oils to recover naphtha, this product being liberated on expansion.

The manufacture of caustic soda for phenol recovery is an essential process, and for its preparation on a large scale a continuous system is adopted. The settling of precipitated calcium carbonate is accelerated by gently moving paddles, and the sludge is continuously dried on a revolving filter ready for recalcination, if this is commercially justifiable. Little power is used in mixing the oils with caustic soda solution when the agitation is done by creating a vortex and breaking the surface by shallow baffles.

In rectifying naphthas, a very good column is one in which the vapours travel in a downward direction in each section and are subjected to the scrubbing action of descending condensate.

The entire works and individual plants should be designed to provide a continuous flow of products in one direction, effluents also tending in one direction.

The above processes are in operation or are being installed in the Chemical Works Department of the Glasgow Corporation.

LIVERPOOL.

The annual meeting of the Section was held on April 29 at the Adelphi Hotel, Liverpool, Dr. E. F. Armstrong presiding. Dr. G. C. Clayton, of the United Alkali Co., was elected chairman, in succession to Dr. Armstrong, who now becomes vice-chairman. After many years' good service, Dr. A. Holt retires from the hon. secretaryship in favour of Mr. E. Gabriel Jones, but remains on the committee as hon. treasurer, Mr. Edwin Thompson becoming the Sectional representative on the Chemical Engineering Group. The following were elected to the committee in place of retiring members:—Messrs. C. O. Bannister, G. W. Beaumont, A. E. Findley, E. L. Peck, and Edwin Thompson.

After the business meeting, a paper on "Mustard Gas" was read by the President, Sir William Pope.

YORKSHIRE.

Mr. S. H. Davies presided at the annual meeting of the Section held at Leeds on May 2. The officers were re-elected, and as five members of the committee retired and one member had resigned, the following were elected to fill the vacancies:—Messrs. C. P. Finn, W. B. Hill, H. J. Hodsman, P. E. King, F. W. Richardson, and B. Watmough. The chairman said that unfortunately there had been few papers read during the past session, but it was hoped to have more next year, and it was proposed to hold meetings in centres other than Leeds, such as Sheffield, Huddersfield, or Bradford.

Prof. A. Smithells then gave a demonstration, with models, of modern views of the chemical atom, his aim being to set his audience re-studying the broad fundamentals of the subject, especially Dr. Irving Langmuir's paper on the arrangement of the electrons in the atom. The advance of chemical theory since Dalton's time was sketched, the conceptions of Dalton, Berzelius, and Van't Hoff being illustrated by models representing washing soda. Study of radio-active disintegration pointed to the necessity of going beyond the atom and of postulating its complexity and an electrical theory of matter. The existence of the electron is now questioned by no one. The lecturer referred to the isolation of the negative electron and the association of mass with the positive electron, the Bohr hydrogen atom, and the Rutherford atom. Before describing the Langmuir atom, the postulate was put forward that in order to be of service to the chemist it must explain the chemical properties of the elements as expressed, say, in the periodic classification of the elements, and their stability chemically and physically must be in accordance with the theory. The Langmuir atom was then illustrated by models and its accordance with the properties of the elements of the helium series was brought out. Langmuir's view of the combination of the elements was demonstrated, and a model showing the structure of the sodium carbonate molecule was built up from models of the constituent atoms. Other interesting models dealt with the methane molecule, the similarity of the nitrogen and carbon monoxide models from the point of view of their inactivity, and the atom of nickel.

LONDON.

The annual meeting was held on May 2, at Burlington House, W. Mr. Julian L. Baker, the chairman, in the course of an address, announced that Mr. E. V. Evans was to succeed him in the chair, and that Dr. Monier-Williams had been re-elected hon. local secretary. At the six meetings of the Section which had been held so far eight papers had been read, and the average attendance had been 97 members and 21 visitors. The committee had had under consideration the question of holding joint meetings with the Chemical Engineering Group, and it was hoped that it would be possible to arrange occasional joint meetings of the Société de Chimie Industrielle and either the parent Society or the London Section. He appealed to members to make every effort to attend the Annual Meeting in Canada, and he also drew attention to the informal dinners of the Section which were held before the meetings, and at which a better attendance was desirable.

The following were elected to fill vacancies on the committee:—Messrs. R. T. Colgate, H. G. Colman, H. F. E. Hulton, S. Miall, H. P. Stevens, and E. W. Voelcker.

The following papers were then read:—(1) "Fractional Distillation with Contract-ring Still-heads," by Dr. R. Lessing; and (2) "Thermal Losses in the Gas Producer Process," by Mr. N. E. Rambush.

(1) Dr. Lessing's contact-rings consist of metal cylinders of approximately equal height and diameter, provided with a narrow slit from end to end and a diametrical partition connected to one side of the slit. They are dropped promiscuously into a cylindrical still-head, and owing to the large amount of free space remaining, about 87 per cent., the resistance in the still-head is almost negligible. The author's experiments have shown that the efficiency of these heads is greater than that of any other dephlegmator, and is due to the large surface per unit of volume, the turbulence caused by frequent deflection of currents of vapours and condensate, and the consequent absence of channelling. Maximum efficiency may be obtained by lagging or heating the still-head and by super-imposing a reflux condenser. The rings, which are made of copper or aluminium, are used in scrubbing-towers, condensers, heat-exchangers, etc., especially when a minimum of back pressure is essential; for such purposes the size recommended is 1×1 in., but smaller sizes are available for laboratory use.

(2) Mr. Rambush's paper described the results of an exhaustive research on the cause of the heat-losses in the gas-producer process. The factors concerned in the losses are:—(*a*) The moisture-content of the fuel, which is roughly proportional to the thermal loss; (*b*) the amount of condensable volatile matter obtained by gasifying the fuel; (*c*) the loss of dust and soot due to high gas velocities and high temperatures, which may lead to a loss of 3 per cent. in the heating value of the fuel; (*d*) the ash content of the fuel—the higher the ash content the greater the amount of unburnt carbon; (*e*) radiation and convection, which cause a loss of about 1 per cent. in the heating value of the fuel gasified; (*f*) leakage due to poking, cleaning, and bad joints, which may amount to a loss of at least 1 per cent. of the heating value; (*g*) the mechanical removal of gas and the solution of gas and tar in the cleaning plant may cause a loss of 1 per cent.; (*h*) the water-vapour content of the gas derived from the undecomposed blast steam, the amount of which depends upon the time factor; (*i*) the heat carried away in the hot gases from the producer causes the highest thermal loss in cold gas producers, but is negligible in the case of hot-gas plant. When using fuel unevenly graded or in large pieces the fuel depth must be greater to ensure efficient gasification. The heat loss in the hot ashes is negligible, ranging from 0·1 to 0·5 per cent.

The author described his method of calculating the thermal efficiency of a producer plant, and his results were in good agreement with those obtained in actual practice. The relative losses obtained in various forms of plant when using an average English coal were found to be:—Hot gas producer (if cooled), 17 per cent.; cold gas producer (without recovery), 14 per cent.; and the ordinary Mond type of by-product producer, 16 per cent.

MEETINGS OF OTHER SOCIETIES.

THE ROYAL INSTITUTION.

The Friday Evening Discourse on April 22 was delivered by Sir James Walker on "The Electrosynthesis of Organic Compounds." The ionic theory of electrolytic conduction was briefly reviewed, and incidentally it was pointed out that electrolytic vessels now used are still very similar in form to those employed by Faraday, whose studies were confined entirely to the electrolysis of solutions of inorganic substances. In preparing ethane by the electrolysis of an aqueous solution of sodium acetate in 1849, Kilbe established his right to be regarded as the pioneer of the electro-synthesis of organic substances. In 1890 Crum Brown attempted to extend Kolbe's method by electrolysing sodium ethyl tartrate, but without result. The lecturer had then pursued the subject by attempting the electrolysis of sodium ethyl malonate. The result indicated a general method for the electro-synthesis of organic substances which may be represeuted by the equation:—

$$\left.\begin{array}{l}\mathrm{NaOOC.X.COOC_2H_5} \rightarrow \overset{+}{\mathrm{Na}}+ \\ \mathrm{NaOOC.X.COOC_2H_5} \rightarrow \overset{+}{\mathrm{Na}}+\end{array}\right|\begin{array}{c}\mathrm{CO_2} \\ \mathrm{CO_2}\end{array}\Bigg| +\mathrm{C_2H_5.OOC.X_2.COO.C_2H_5}$$

where X represents any organic group. The C_2H_5-group in the resulting synthetic product may be substituted by sodium and the synthesis carried a step further, whereby a product containing four X-groups is obtained. The method can be applied to the electrolysis of mixtures, thus enabling compounds to be synthesised which contain groups X in the order of their natural number. In the particular case where X represents the CH_2-group, the electrolysis of sodium ethyl malonate results in the production of diethyl succinate. In this manner the lecturer had succeeded in synthesising from malonic acid, substances containing up to 16 CH_2-groups. Substances containing 32 CH_2-groups had not hitherto been synthesised in this manner—probably owing to electrolytic difficulties connected with the fact that these synthesised products were of the nature of soaps. The method had not hitherto been applied with success to the electro-synthesis of aromatic substances, but investigations were now being made. Generally speaking, investigation of the electro-synthesis of organic compounds had been much neglected in recent years.

THE OPTICAL SOCIETY.

At a meeting held on April 14, Mr. F. Twyman, of Messrs. Adam Hilger, Ltd., described "An Interferometer for Testing Camera Lenses," which is an application to camera-lens testing of the principles of an earlier instrument described in the Philosophical Magazine (Phil. Mag., 35, Jan., 1918), but it differs from the lens interferometer there described in that the camera lenses can be tested for oblique pencils. The instrument gives aberrations in the form of an interference picture (that can be photographed), which is a contour map of the aberrations of wave-front expressed in wave-lengths of light in comparison with the wave-front of a perfect camera lens.

A paper on "The Testing of Heliograph Mirrors and the Measurement of Mirrors of Long Focal Lengths" was read by Mr. W. Shackleton. The method of testing the general surface consists in observing the reflection from the mirror of a system of squares on the test board, the magnification giveu by the mirror being utilised to determine the curvature. The method of examination is applicable to the rapid measurement of mirrors of long focal length, especially of those forms silvered on the back, cata-dioptric mirrors, where the usual methods of measurement, test planes or spherometers, are inapplicable. Defects of curvature and distortion, astigmatism, and striæ in the glass can be detected, and also defects of silvering and bad polishing.

THE INSTITUTE OF PHYSICS.

The inaugural meeting of this new professional body was held in the hall of the Institution of Civil Engineers on April 27. Sir Richard Glazebrook, who presided, urged the claims of physics in national life, and said that its utility during the late war had done much to impress the nation with its essential importance. There were already about 300 members in the Institute, including most of the leaders in physical science.

Sir J. J. Thomson, the president-designate, compared the conditions to-day with those of 50 years ago. Then there were probably not more than about 100 physicists and a dozen small physical laboratories in the country; the only posts open to physicists were badly-paid professorships and worse-paid school appointments. The number of laboratories had very greatly increased, but the supply of physicists, although it had also increased, was far below the demand. There was a great need of physicists in industry, not only in the laboratories but in the works themselves. Science students at the Universities should spend at least one year on research, if only on account of the mental discipline it afforded. "Research develops character, increases independence of thought, and develops resourcefulness, critical power, and enthusiasm; in fact, it raises the student from intellectual adolescence to intellectual manhood." The growth of physical research was illustrated by the increased number of original papers published; he estimated that there were about 2700 such papers in 1913, as against 400 in 1873. Although pioneer work was of the first importance, routine work was nevertheless essential.

The Rt. Hon. A. J. Balfour claimed that physics was the most fundamental of all the sciences, and said it was surprising that this country had had to wait until 1921 for the foundation of an Institute of Physics. He was doing his best to help on the admirable work of the Department of Scientific and Industrial Research, about which the public knew so little; but the public seldom knew much about what concerned it most. If half the time and half the money now being spent on petty squabbles about the division of the products of industry were devoted to increasing the power of man over Nature, there would be much more of those products to divide among the community. Expenditure of money and energy and the mere multiplication of students would not increase the number of great discoverers; but organisation and money were needed for that routine work which was absolutely essential to the promotion of great discoveries and to bring them to fruition. No money was better spent than on scientific research, and he was often surprised that the imagination of great magnates was not stimulated by the thought that by encouraging research they could effectively add to the wealth of the whole world. A fruitful discovery not only benefited the company, or capitalist, but it often touched the lives of every dweller in every civilised country, and no one could truthfully say that that was a low, material view of things. The idea of progress which held out most hope for the future was that the growth of science and invention would bring comfort and leisure—to those who knew how to use it—where at present discomfort and labour were the necessary conditions of production.

THE TEXTILE INSTITUTE.

The report presented to the annual meeting held in Manchester on April 27 refers to the loss by death during the year of Sir William Mather and of the president, Sir A. Herbert Dixon. The Foundation Fund, by means of which the Council hopes to embark on a definite programme of work, is as yet far short of the £50,000 required; nevertheless the annual income from the sum already raised has permitted an extension of activities which would otherwise have been impossible. The Compton Prize Scheme competition for advanced students is working successfully; the *Journal* has undergone important developments, and the institution of the annual "Mather" Lecture has proved of distinct value. There has been a substantial increase in membership, which now numbers 915.

In moving the adoption of the report the president, Colonel F. R. McConnel, made a number of suggestions for extending the scope and influence of the Institute, and said it was hoped that the committee charged with the work would soon complete the plans for a system of fellowships. The Institute, he said, was doing excellent service in showing how all ranks in industry could cooperate in attacking technical and scientific problems, and to that extent was influencing for good the relations between employer and employed.

After the business meeting Mr. W. E. Baker read a paper on "Ball and Roller Bearings as applied to Spinning, Weaving, and Finishing Machinery," which, from the chemical standpoint, was of interest, as it drew attention to the extreme cleanliness obtained by means of ball-bearings; at the present time large quantities of valuable material—yarn, cloth, and liquors—are spoiled by the dirtiness of plain bearings and the drip and throwing of dirty oil from them.

SOCIETY OF PUBLIC ANALYSTS.

At the meeting held on May 4, Mr. A. Smetham in the chair, Messrs. F. G. H. Tate and J. W. Pooley contributed a paper on "Detection and Estimation of Illipe Nut Fat used as a Substitute for Cocoa Butter," in which they described a method of calculating the percentage composition of any mixture of these two fats from the densities, the melting-points of the fat and fatty acids, the viscosity and the iodine value. Dr. G. W. Monier Williams demonstrated an inexpensive apparatus for determining hydrogen-ion concentration, and discussed the underlying theory and its application to analytical work. In "A Note on the Oil of Oats," Mr. E. Paul described some work on the extraction with petroleum ether of whole-ground oats of the "Black Tartary" variety. Lecithins were found in the extract, and the constants of the separated oil were determined. The last paper was by Mr. H. Atkinson on the "Estimation of Potassium in presence of Sodium, Magnesium, Sulphates and Phosphates." The method described is based upon the relatively low solubility of potassium perchlorate in methyl alcohol compared with the solubilities of the perchlorates, sulphates, and phosphates of magnesium and sodium.

THE CHEMICAL SOCIETY.

Four papers were read at the meeting held on March 5, Dr. M. O. Forster presiding. "Amylases of the Cereal Grains: Rye" was presented by Mr. Julian L. Baker and Mr. H. F. E. Hulton, who have found that when ungerminated rye diastase acts upon starch paste or soluble starch at 50° C., crystallisable maltose and α-amylodextrin only are formed. Rye diastase, however, is superior to barley in its capacity to liquefy starch paste, and it also gives a somewhat higher yield of maltose. The diastase of germinated (malted) rye gives from 76—86 per cent. of readily crystallisable maltose and a reducing dextrin having $[\alpha]_D=+184$ and a reducing power of 10 (calculated as maltose). No intermediate products degradable by the further action of diastase (malto-dextrins) were obtained as when barley malt diastase acts upon starch paste under similar conditions.

In a paper on the "Hydrolysis of Cotton Cellulose," Dr. G. W. Monier-Williams described how he had converted cotton cellulose almost quantitatively into crystalline dextrose by direct hydrolysis. Ten grams of cotton wool were dissolved in 50 c.c. of 72 per cent. sulphuric acid and the viscous solution allowed to stand for one week. It was then diluted to 5 litres with water and the solution boiled for 15 hrs. After removal of the sulphuric acid with barium carbonate, the filtrate was evaporated to dryness under reduced pressure, being kept neutral to methyl red during the evaporation by repeated addition of sulphuric acid in small quantities. The sugar was extracted by methyl alcohol from the dry residue, and the methyl alcohol solution, after decolorisation with animal charcoal, slowly evaporated in a current of dry air. The residue was crystalline and contained 94·6 per cent. of dextrose, 3·3 per cent. of moisture, and 1·5 per cent. of ash. Calculated on the dry, ash-free cellulose, the yield of glucose amounted to 90·6 per cent. of the theoretical quantity.

The two other papers presented were:—"The Formation and Stability of Spiro-compounds. Pt. IV. The formation of ketones derived from open-chain and cyclic glutaric acids by the thermal decomposition of their calcium salts": G. A. R.

Kon; and "The Conditions underlying the Formation of Unsaturated and Cyclic Compounds from Halogenated Open-chain Derivatives. Pt. II. Products derived from α-halogenated adipic acids": C. K. Ingold.

SOCIETY OF GLASS TECHNOLOGY.

The fourth annual general meeting was held at University College, London, on April 20, 1921. The report stated that the total members on the roll at the end of 1920 was 620, 128 members having been elected during the year. There was a small deficit on the year's working, due to the increased cost of printing the Society's Journal. After the election of officers, the new president, Dr. M. W. Travers, delivered his presidential address on "The Importance of Quantitative Investigation in dealing with Technical Problems in the Glass Industry."

Lord Moulton, who was to have presided at the dinner that evening, had insisted upon the observance of the principle that industrial processes must be based upon quantitative investigation, with the result that whenever his Department took over a factory it was almost invariably found possible to increase the efficiency of the processes carried out in it. Efficiency resulted from the economic use of money or credit, labour, materials, and energy, and was only possible when the losses under each heading could be accurately ascertained. The energy balance-sheet was really as important as the financial balance-sheet, and each should be drawn out with equal care. Just as it was impossible to check waste of money if one merely kept account of gross receipts and expenditure, so it was equally impossible to check waste of energy if one knew only the total fuel consumption in a furnace. Each furnace should be studied with a view to ascertaining whether unnecessary losses could be checked, the fuel consumption reduced, and the efficiency increased. The investigation of the nature of gas-producer tar, its composition, heat of formation, and its influence on the efficiency of heat exchange in the furnace should be investigated; also the actual temperatures of the gases as they entered and left furnaces. Furnace design should be based upon quantitative knowledge of the laws of the flow of gases through channels and spaces. The outlet flues from a pot furnace were not made small in order *to keep the heat in the furnace*, but because the velocity of the gas through a flue of small section was necessarily high, and when the velocity of the outflow was high, comparatively large fluctuations in the pressure in the furnace induced relatively small changes in the rate of outflow.

A paper on "Automatic Glass-feeding Devices," by Messrs. G. Dowse and E. Meigh, was read by the latter.

The third annual dinner of the Society was held on April 20 at the Hotel Cecil. Dr. M. W. Travers presided, and the guests included Mr. A. Chaston Chapman, Prof. F. J. Cheshire, Mr. Dennis Herbert, M.P., Mr. W. Ide, Master of the Glass Sellers' Company, and Mr. R. S. Whipple, president of the Optical Society. Replying to the toast of "The Society of Glass Technology," proposed by Mr. A. Chaston Chapman, Dr. Travers referred to the proposed legislation for the protection of the scientific branch of the industry. The view that the tariffs suggested were unsuitable and inadequate was held not only by the manufacturers, but also by the scientific and industrial worlds dependent upon supplies of chemical glassware. The only assistance which would enable this branch of the industry to continue was the total prohibition of all chemical glassware except under licence. It was a matter of great regret that electric-lamp bulbs had not been provided for in the Bill.

NEWS AND NOTES.

SOUTH AFRICA.

The Fertiliser Industry.—According to a statement made by Major C. C. Frye, of the Cape Explosives Works, Ltd., his company is about to extend greatly the manufacture of fertilisers and hopes within a few months to supply the whole of the fertiliser requirements of the Union, which are said to be approximately 100,000 tons per annum. The cost of the buildings and plant (which are now in course of erection) will not fall far short of £250,000. Every kind of fertiliser is to be sold by the company. —(*S. Afr. J. Ind., Mar.*, 1921.)

AUSTRALIA.

Starch Production from the Zamia Palm in New South Wales.—As a result of investigations carried out by the Institute of Science and Industry, the Austral Starch Co. has been formed to produce starch from the Zamia palm. A factory has been erected on the south coast of New South Wales, and is about to commence operations. The company has been granted a licence to obtain Zamia bulbs from an area of 31,000 acres in the vicinity of Currawan, on condition that not less than 50 tons of dry starch shall be produced half-yearly.—(*Ind. Austral., Feb.* 24, 1921.)

Conservation of Wheat in South Australia.—During the war the conservation of the South Australian wheat crop was placed under the control of a scientific committee of which Dr. W. A. Hargreaves, Director of the Department of Chemistry, S.A., was chairman. Two methods were used successfully:—(a) Treatment with Gas. The stacked grain was enclosed in sheds covered with "malthoid" made as airtight as possible. Then air, freed from oxygen by being passed through a furnace similar to a gas producer but designed to give carbon dioxide, was blown into the shed for three or four weeks to asphyxiate the insects. As many as 200,000 bags of grain have been treated at one time with success. (b) Heat Treatment. Dr. Hargreaves has modified the Poole and Steele machine, in which the wheat is passed through a hot zone at 140°—150° F.; this method was put into practice in 1918, and large quantities of wheat have been successfully treated by it.

CANADA.

Mining in British Columbia.—On account of the continued low price of copper, the Granby Consolidated Mining, Smelting and Power Co. has reduced the wages of its employees, but the output of over 116 tons a month is still maintained. The Consolidated Mining and Smelting Co. is maintaining its zinc output with ore from the Sullivan mine, and its output of gold and copper has been increased. Now that the British American Nickel Corporation has closed its plant at Nickelton and the refinery at Deschenes, Que., the copper refinery of the Consolidated Co. is the only one at present operating in Canada. The concentrating plant of the Britannia Mining and Smelting Co., which was closed on November 30, 1920, owing to the low price of copper, has recently been destroyed by fire. With a daily capacity of 2500 t. of ore, the plant crushed 650,000 t. of ore during the first eleven months of 1920, and produced concentrates that yielded 8036 t. of copper. Practically none of the lead mines in the Slocan camp, the chief silver-lead mining area in British Columbia, is producing, but development work is proceeding at the Silversmith and a few other mines. A large belt of zinc-lead sulphides, 40 ft. wide and 3500 ft. long, has been uncovered at Bellevue, on the Illiance River, Alice Arm district, where some of the small veins contain up to 150 oz. of silver and $2·20 in gold per ton.

The iron and coal deposits of the Copper River district have been examined on behalf of British interests, and if the properties are acquired blast furnaces will be erected near Port Edward, and the Provincial Government will pay bounties of \$3 per ton of iron produced from domestic ores, and \$1·50 per ton of iron produced from foreign ores.—(*Canad. Chem. & Met., Apr.*, 1921.)

JAPAN.

The Dextrin Industry.—The manufacture of dextrin in Japan has been organised on a commercial scale only within the last three or four years. At present the cost of production is about \$5·53 per 100 lb., whereas the selling price on the Osaka and Kobe markets is roughly \$5·13 per 100 lb. for white and \$5·58 for yellow dextrin. Thus the manufacturers are not making a profit, and unless the cost of production is reduced by lowering wages and prices of raw materials the industry may not survive the present depression. There are three small factories situated in Osaka, Tokyo, and Kyushu, respectively, and the total output of the whole country is about 300 tons a month. Dextrin is mainly used in the textile industry, and the Japanese product is exported chiefly to Great Britain.—(*U.S. Com. Rep., Mar.* 15, 1921.)

The Dyestuffs Industry.—The decline in prices subsequent to the armistice brought about severe depression in the Japanese dye industry, but imports of German dyestuffs were limited in amount, and some manufacturers resumed work late in 1919, the output in Tokyo-fu for the first five months of 1920 reaching a value of 1,503,000 yen (£153,306). The economic crisis which set in in April again curtailed production. Dyestuffs manufacture in Tokyo-fu began with Kryogene Black and was gradually extended to include Kryogene Brown, basic, acid, direct, mordant, and other dyes. The production of Kryogene and other dyes is given below:—

	Kryogene dyes.		Other dyes.	
	Long tons.	£	Long tons.	£
1918	176·5	38,913	290·4	359,329
1919	226·8	13,933	140·6	169,199
1920 (to May)	486·7	53,917	72·6	99,474

It will be seen that there was a considerable improvement in the output of Kryogene dyes up to the end of May, 1920, and that the production of other dyes was greater than in 1919, although much below that of 1918.—(*Bd. of Trade J., Apr.* 21, 1921.)

BRITISH INDIA.

Mineral Production in 1919.—In his report for 1919, the Chief Inspector of Mines states that the output of coal was 21,759,727 tons, or 9·64 per cent. more than in 1918; nearly 70 per cent. of the production came from the Province of Bihar and Orissa. The coal used for coking amounted to 1,025,168 t., and 278,473 t. of hard and 308,565 t. of soft coke were made; the increased production of hard coke was chiefly due to the exceptional prosperity of the iron and steel industries. The output of coal per person employed was (a) below ground, 185 t., and (b) above and below ground, 114 t., compared with the average figures of 178 and 113, respectively, during the five preceding years. Owing to the cessation of the war demand, the accumulation of stocks, and the rise in exchange (factors which affected most minerals), the output of mica declined by 19·18 per cent. to 2084 t.; production was cut down and Government control of the mica industry terminated. Demand for manganese was on the whole worse than in 1918, and prices declined; the output was 1·16 per cent. higher at 420,184 t. The decline in the output of wolfram continued, and the output was 2905·4 t., a decrease of 19·5 per cent.; production remained normal during the first four months, but in May the purchase price dropped from 72 to 30s. per unit, and by the end of the year the number of producing mines had fallen from 84 to 39. The output of copper ore was 32,756 t., compared with 3619 t. in 1918; 980 t. of copper was produced by the Cape Copper Co., which completed its mill and smelter at the Rakha mines in the Singbhum district. There was a decrease of 43·81 per cent. in the output of gold (11,191 oz.), and a decrease of 3·37 per cent. in that of gems (158,577 carats), despite the demand at higher prices for rubies and sapphires. There were increases in the production of limestone, salt, slate, magnesite, bauxite, clay, tin, fullers' earth, samarskite, graphite, ochre, and molybdenite, and decreases in silver, iron ore, chromite, galena, steatite, barytes, apatite, and potash.—(*Ind. Tr. J., Mar.* 18, 1921.)

FRANCE.

Industrial Notes.—*Metallurgy.*—Despite the uncertainty regarding the final financial settlement with Germany, the demand for pig iron and rolled products appears to indicate that trade in metallurgical products is reviving, and the keenness of demand for several finished products is a sure sign that consumers' stocks are running short. The question of exportation is again becoming prominent and a scheme is being considered involving an understanding between various iron and steel companies, and reduced transport charges to encourage exportation. It is also proposed to sell coal and coke from the Saar and Rhineland districts at special prices to exporting firms. The "Basset" process for the production of iron and steel direct from the ore (*cf.* J., 1920, 304 R) is still attracting attention, but no definite statement can yet be made as the process is apparently still in the experimental stage. It is stated, however, that the cost of production is very low, so low in fact that were the cost to hold good in large-scale practice the process would revolutionise metallurgical production. Preliminary experiments are being carried out with 25-ton furnaces at Dennemont, near Mantes, and steel for rails has been produced. Three works with four furnaces, each of a capacity of 250 metric tons a day, are being erected in Normandy for a new company, "La Société des Aciéries Basset," which is working the process and whose activities may later be extended to Eastern France and even abroad.

An "Aluminium Week," to be held in Paris from May 21 to 29, is announced by the Société d'Encouragement pour l'Industrie Nationale. There will be an exhibition and a series of lectures to encourage the use of aluminium, magnesium, calcium, and sodium, and to promote new applications.

Liquid Fuel.—Pending a definitive arrangement, import licences will be required for liquid fuels as from May 1, 1921, and the following conditions will have to be complied with:—(*a*) The importer must purchase from the State a quantity equal to the amount imported; (*b*) a tax of 15 fr. per hectolitre will be levied to compensate the State for losses due to the depreciated value of its stocks; (*c*) 25 per cent. of the quantity of liquid fuel imported must be kept continously in stock; and (*d*) the consumer must benefit from the lower prices accepted by the State.

Chemical Industry.—As yet there is no sign of improvement in the French chemical market, and several foreign markets, particularly Greece and South America, have been closed to France by German competition. Many German chemical products, particularly pharmaceutical chemicals, are even now finding their way into France, but a higher protective tariff and a general *ad valorem* duty on German imports should remedy this state of affairs. It is felt, however, that the real solution lies in developing the French chemical industry so that it may turn out first-class products at minimum cost. The Cie. Cellulose Française d'Alfa, formed to manufacture paper and pulp from Algerian alfa, is contemplating the purchase of the Government's explosives factory at Toulouse, which has been practically dormant since the armistice. It would take 3—4 months to adapt the machinery to the company's requirements. The raw material would be shipped from Algeria to Cette, brought by canal to Toulouse, where it would be stored, and then carried by rail to the factory as required. The initial production is estimated at 20 metric tons of pulp from 40 t. of alfa, and the treatment would require 30 t. of coal, 1·5 t. of hydrochloric acid, and 3 t. of caustic soda; plant is available locally for the production of chlorine and caustic soda. It is estimated that paper pulp could be produced to sell at about one-half of the current price.

Alsatian Potash Mines.—The proposal to entrust the development of the Alsatian potash mines to a single company has been rejected by the Government Commission which is examining the question, and it has been decided to hand over the mines to four companies, which will have a common sales organisation both for home and foreign markets.

Meeting of Civil Engineers in France.—The summer meeting of the Société des Ingénieurs Civils de France will be held in France from June 18—24 next. The first five days will be devoted to a tour in Eastern France, including the battlefields of Verdun and the factories of Lorraine, and the last two days will be spent in Paris. Full particulars of the programme may be obtained on application to the offices of the British Section at 45, Great Marlborough Street, London, W. 1.

The Perfume Industry in the Lyons District.—Of late years the manufacture of artificial and natural perfumes in the neighbourhood of Lyons has expanded considerably, largely owing to the favourable geographical position and to the interest shown by the University of Lyons in offering a special course in perfumery. The Far East, Madagascar, and North Africa are the main sources of the raw materials used, but large supplies of lavender, iris, roses, etc., are obtained locally. The oil of verbena is transformed into violet, artificial iris and synthetic lily of the valley, oil of camphor into heliotrope, aniseed into anethol and artificial hawthorne, clove oil into vanilla, Guiana rosewood into bergamot, Madagascar faham into coumarin, etc. Lavender oil is produced in the Lyons district to the value of 10 million francs per annum, which, it is claimed, is 90 per cent. of the world's output. More than 12,350 acres are laid down to lavender in the district, but the cultivation of other flowers has been temporarily supplanted to some extent by that of food products. Synthetic perfumes are also manufactured and many of the factories which produced organic chemicals during the war now make perfumes. Thus, the toluene of a local firm is used for producing jasmine, artificial rose, as well as benzoate of soda, and the firm of Junillon, at Valence, makes a speciality of the production of synthetic musk from xylene. At present the industry is suffering from the trade depression, stocks have accumulated, and the principal buyers—America, England, and Japan—are not placing orders—(*U.S. Com. Rep., Feb.* 28, 1921.)

UNITED STATES.

The Beet-Sugar Crop in 1920–21.—It is estimated that if weather conditions remain favourable the United States beet-sugar crop for 1920–21 will amount to 997,710 long tons, the largest crop ever produced in that country. Previous crops have been as follows:—1915–16, 780,550 t.; 1916–17, 732,700 t.; 1917–18, 683,000 t.; 1918–19, 674,900 t.; and 1919–20, 653,000 t. Compared with last year, an additional 333,710 t. of home-grown sugar will probably be available, and as the United States is a large importer (*cf.* J., 1920, 183 R), this decrease in requirements of foreign sugar may influence sugar prices in the world markets.—(*Ind. Tr. J., Apr.* 1, 1921.)

Gypsum in 1919.—The quantity of gypsum mined in the United States in 1919 was 2,420,163 short tons, an increase of 18 per cent. over the output in 1918. All the producing States except Oklahoma showed an increase in output, ranging from 11 to 43 per cent., and large increases in value were also recorded. The distribution of the production was as follows:—Uncalcined: For Portland cement, 470,267 short tons; agricultural gypsum, 39,978 t. Calcined: Plaster of Paris, wall plaster, Keene's cement, etc., 1,393,141 t.; for glass manufacture, 14,677 t.; as boards. tiles, blocks, etc., 188,202 t. There were 56 active mines, quarries, and pits in the United States and Alaska, and these supplied 54 domestic calcining plants; most of the mills are equipped with kettles, but the number of rotary kilns is increasing, there being eight in 1919. Rock gypsum was mined in 41 localities, gypsite in 14, and selenite crystals in one. The imports of gypsum, mainly from Nova Scotia and New Brunswick, increased to 172,000 t. of crude and 10,000 t. of ground or calcined gypsum. Exports of plaster or wall board were valued at $1,141,815, an increase of nearly 171 per cent. over 1918, England being the largest buyer (27 per cent.), followed by Japan, Canada, and Australia. The demand from South America continued to grow (*cf.* J., 1920, 76 R).—(*U.S. Geol. Surv., Dec.* 28, 1920.)

Salt, Bromine, and Calcium Chloride in 1919.—Owing to transport deficiencies and the cessation of war demand, the production and sale of salt in 1919 declined by 4·9 per cent. to 6,882,902 short tons. During the war output rose by 9·8 per cent. in 1915, 18·9 per cent. in 1916, and by 9·7 per cent. in 1917, the use of electrolytic chlorine in the manufacture of poison gases being mainly responsible for the increase. Fifteen States produced salt in 1919, the chief being Michigan, New York, and Ohio, and there were 102 operating plants in the whole country, the same number as in 1918. The production of rock salt was 1,642,057 short tons, mined by 21 firms in seven States, chiefly in New York and Kansas, and that of brine salt was 5,240,845 t., largely from Michigan and New York. Brine salt alone was produced in greater quantity than in 1918, and as it is usually sold to or produced by chemical works, the variations in its production may to some extent be regarded as an index of the state of the chemical industries. Imports of salt for curing meat and fish amounted to 62,821 short tons, and were obtained mainly from Spain, British West Indies, and England; in 1918 the import was 40,320 t., and the pre-war average 150,000 t. Exports totalled 119,416 t., the decrease of 13 per cent. being probably due to a return to normal conditions.

About 928 short tons of bromine, valued at $1,234,969, was produced from the usual source, viz., bittern left after extracting salt from brine. Notwithstanding the cessation of the war demand, the production increased by 7·5 per cent. compared with 1918; the total given includes bromine marketed as bromides and other bromine salts.

The production of calcium chloride from natural brines was 26,123 short tons, a decrease of 1·9 per cent. Michigan, Ohio, West Virginia, and California remained the chief producing States of this type of calcium chloride (that produced in the ammonia-soda process being excluded); it contains from 2 to 6 per cent. of magnesium as an impurity (*cf.* J., 1919, 28 R).—(*U.S. Geol. Surv., Mar.* 26, 1921.)

GENERAL.

Increased Capitalisation of the German Chemical Industry.—The reports of the largest German chemical companies, published last month, show that enormous increases of capital are contemplated. The capitals of the Farbenfabriken vorm. Friedrich Bayer and Co., of Leverkusen, the Farbwerke vorm. Meister Lucius and Bruning, of Hochst, and the Badische Anilin- und Sodafabrik, of Ludwigshafen, are each to be raised from 252 to 430 million marks, *i.e.*, from about 12·2 to 21·5 million pounds at par (1 to 1·7 million pounds at the current rate of exchange); and the A.-G. fur Anilinfabrikation ("Agfa") in Berlin proposes to raise its capital from 88 to 146 million mk. Thus, these four companies are to increase their combined capitalisation by 622 million marks (£31,100,000 at par). A large proportion of this sum is to be allocated to supply the future capital requirements of the German nitrogen works at Oppau and Merseburg, and the remainder is ear-marked for renewals and repairs, which in some works were not carried out during the war, and for re-converting certain factories to peace-time production. This policy of capital enlargement is also being pursued by other companies, *e.g.*, the Fabrik Griesheim-Elektron proposes to increase its capital from 63 to 108 million mk., and Leopold Cassella and Co., in Frankfurt, from 113 to 185 millions. A comparison of these enormous figures, together with the sums expended on dividends in 1920–21 and the large amounts placed to reserves, with the corresponding figures for the period 1913–18, shows the undermining effect of the depreciated currency. The following are the official figures for the market values of German chemical securities in 1913, 1914, and 1918, in millions of marks:—

	1913.	1914.	1918.
Shares	19·7	2·8	14·3
Debentures, etc.	4·5	8·7	24

The division of the share capital and the dividend records of seven of the chief companies are given below:—

	Ord. shares.	Pref. shares.	Dividends (%).		
	million mk.		1918.	1919.	1920.
Badische	180	72	12	18	20
"Agfa"	63	25	12	18	20
Elberfeld	180	72	12	18	20
Griesheim-Elektron	45	18	7	12	—
Höchst	180	72	12	14	20
Kalle & Co.	6	—	7	14	—
Weiler-ter-Meer	16·6	6·7	10	12	15

In judging the significance of the large profits and dividend disbursements, it is necessary to take into consideration the depreciated currency and the fact that the plant and machinery were acquired before that depreciation took place. The shares of the "Agfa" company are quoted at 435—535 (for the 100 mk. share) so that the dividend represents only a very small return on the invested capital at its current value. Nevertheless, the figures show that the year 1920–21 was on the whole a satisfactory one. Recently the threatened "sanctions" have much increased the difficulties of production. For months past sales have been declining; in some works stocks have accumulated, and purchasers have been demanding larger and longer credits. Prices, too, have fallen without any corresponding decline in costs of production, and a few plants have temporarily closed down. The imperative necessity for making large allocations to plant depreciation has been strongly urged by Dr. Duisberg, on the ground that the amounts now being written off are paper values, whereas the existing plant and apparatus were mostly purchased on a gold basis. For example, the depreciation of a plant which cost 1 million mk. five years ago would in normal times be reckoned at 10 per cent. per annum; but this assumes that at the end of 10 years the plant could be renewed for another million. If, however, as at the present time, the cost of renewal is 10, 15, or 20 millions, it is obvious that a writing off at the rate of 100,000 mk. per annum is quite inadequate.

"Aluminium and Bauxite."—Like the other publications so far issued by the Imperial Mineral Resources Bureau, this pamphlet deals with the war period, in which are included the years 1913—1919. Its chief interest lies in the information it supplies as to the developments which have taken place in various new bauxite fields. Some of these had not reached a productive stage when war broke out and others had barely started to produce. At that time bauxite was only mined on a large scale in France and the United States, but British Guiana, Yugoslavia, and Rumania have since become important producers of the ore, whilst preparations for production are in an advanced state in Dutch Guiana and India. The pamphlet opens with some brief notes on the properties of aluminium and with a list of the chief aluminium minerals. The mineral cryolite is then discussed shortly, and here it is of interest to note that no deposits of this aluminium ore have been found other than the well-known bed in Ivigtut, in South Greenland. A general statement follows on the properties of various classes of bauxite, and attention is drawn to the qualities required according to the use to which the mineral is to be put, *i.e.*, for the production of metallic aluminium, the manufacture of aluminium salts, of refractories or of abrasives.

The section which purports to deal with the uses of the metal will not convey much information, but from the first tables given the interesting conclusion may be drawn that the world's production of aluminium rose from 71,000 tons in 1913 to 170,000 tons in 1918. It is particularly noteworthy that the great increase in the demand which these figures indicate did not call into being any new successful process either for the production of refined alumina or for the reduction of alumina to metallic aluminium.

The occurrence and production of bauxite, the production, imports, and exports of aluminium, and other statistical matter are dealt with in a series of sections devoted to the following countries:—The United Kingdom, Gold Coast, Canada, British Guiana, India, Australia, France, Germany, Italy, Yugoslavia, Rumania, Spain, Switzerland, United States, and Dutch Guiana. Perhaps the most striking facts cited in this part of the pamphlet are the rapid development which has taken place in the productive capacity of the United States and the relatively still larger increase in the Norwegian smelting installations (Norway is not separately dealt with), whilst Germany has only become a serious producer of aluminium during the period under review. The discovery and exploration of extensive deposits of very high-grade ore in the Gold Coast are also notified.

The pamphlet concludes with a bibliography of the literature of the subject during the period dealt with. This is divided into sections on the Occurrence, Distribution, and Mining of Bauxite, The Metallurgy and Metallography of Aluminium, the Alloys of Aluminium, and, finally, the Uses of the Metal and its Compounds.

The Bauxite Industry in British Guiana.—The Demerara Bauxite Co., a British undertaking, has suspended operations on account of the small demand for the mineral in the United States, and an American company is also reported to have closed down for the same reason. The output of both companies has been shipped entirely to the United States, the quantity exported in January last being 8260 tons, valued at $43,169.—(*U.S. Com. Rep., Apr.* 6, 1921.)

Advance Statistics of Production, Exports and Imports of Certain Metals, etc. in 1920.—The Imperial Mineral Resources Bureau has compiled the following advance statistics of production, exportation, and importation in respect of lead, zinc, silver, copper, tin, iron, and arsenic for the year 1920 (long tons throughout):—

PRODUCTION IN 1920.

United Kingdom.

	Long tons.
Pig iron	8,007,900

The Dominion of Canada.

Copper	36,230
Iron, pig, from Canadian ore	67,740
Iron, ore, sold for export	7,013
Lead	15,172
Silver	12,793,541 oz.
Zinc	17,931
Arsenic, white, and in ore	2,150

Australia.

Copper, bar	24,069
In blister	2,000
In ore exported	115
Lead	4,077
Lead bullion	1,939
In lead concentrates exported	4,122
Zinc	9,655
Tin	4,108
Iron, pig	344,000
Arsenic	1,202
Silver	701,177 fine oz

Federated Malay States.

Tin	34,934

Union of South Africa.

Arsenic, white	10
Copper ore and concentrates	9,710
Iron ore	2,289
Lead ore	524
Tin	2,189
Zinc ore and concentrates	2,097
Silver	892,205 oz.

South Rhodesia.

Arsenic	390
Copper, blister	2,775
Tin	4
Silver	158,982 oz.

Northern Rhodesia.

Copper (finished)	130
Lead	14,602
Silver	5,601 oz.

Nigeria.

Tin concentrates	6,022

Belgium.

Raw steel (ingots, etc.)	1,214,121
Finished steel	1,055,580
Finished iron	192,429
Zinc	81,711

France.

Arsenic ore	515
Copper ore	367
Lead ore	4,731
Zinc ore	4,179
Tin ore	20
Iron ore	13,648,257

Italy.

Copper	6,258
Lead ore (including argentiferous)	35,741
Zinc ore	96,514
Silver ore	492
Cupreous iron pyrites	4,329

Cuba.

Copper	7,366

Mexico.

Arsenic	1,180
Silver	33,112,571 fine oz

United States.

Arsenic .. about	6,000
Copper—	
Smelter output from domestic ores	551,339
Refinery production of new copper from domestic and foreign ores	702,232
Iron ore	67,773,000
Iron, pig	36,750,000
Lead (refinery statistics)	469,322
Silver	56,564,504 fine oz.
Zinc (reports of ore-smelters only)	428,368

Chile.

Copper	106,000 to 110,000

Dutch East Indies.

Tin	13,994

EXPORTS IN 1920.

From the United Kingdom.

Pig iron.

To—	Long tons.
Sweden	19,320
Germany	24,484
Netherlands	31,172
Belgium	181,191
France	59,316
Italy	80,652
Japan	26,574
United States	72,558
British East Indies	14,241
Australia	1,127
Canada	3,689
Other countries	65,131
Total	579,455

Lead.

To—	
Russia	617
Sweden	2,223
Germany	421
France	1,473
China (including Hongkong)	780
Japan	2,111
United States	2,998
British South Africa	247
British East Indies	5,331
Canada	7,144
Other countries	11,283
Total	34,628

Zinc (crude and manufactures).

Total	10,308

Copper (plates, rods, bars, blocks, cakes, etc., and manufactures of all sorts).

To—	
Sweden	252
Norway	983
Germany	46
Turkey	873
Brazil	464
Egypt (including Anglo-Egyptian Sudan)	3,600
India	7,996
Straits Settlements*	305
Ceylon	93
Australia	1,261
New Zealand	585
Netherlands	533
Belgium	1,409
France	1,758
Italy	4,101
British East Indies	2,736
Other countries	13,360
Total	40,355

* Including Federated Malay States and Labuan.

Tin (blocks, ingots, bars and slabs).

To—	
Russia	116
Sweden	999
Germany	214
France	1,808
Turkey	370
United States	3,637
Canada	1,113
Other countries	5,078
Total	13,335

From the Dominion of Newfoundland.

Iron ore	510,600

From the Federated Molay States.

Tin	34,934

From the United States.

Spelter from foreign ore	28,500	
Spelter from domestic ore	86,000	
Total		114,500
Copper refined		187,628
Ferro-manganese		3,454
Ferro-silicon		632
All other pig iron		212,742

From Bolivia.

Tin (West Coast shipments only)	29,542

From China.

Tin	11,795

From the Dutch East Indies.

Tin shipments	11,661

From Algeria.

Iron ore	1,096,527
Copper ore	591
Lead ore	12,598
Zinc ore	12,598

Imports in 1920.

Into the United Kingdom.

Pig iron (acid, basic, forge and foundry).

From—	Long tons.
Sweden	29,328
United States	20,574
Other countries	164,407
Total	214,309

Zinc, crude and manufactures (including rolled sheets and plates).

Total	116,891

Lead (pig and sheet).

From—	
Spain	58,149
United States	9,756
Mexico	1,049
Australia	57,987
Other countries	35,909
Total	162,850

Copper (bars, blocks, ingots, plates, sheets, etc.).

From—	
Australia	22,877
United States	37,817
Chile	13,323
Other countries	38,461
Total	112,478

Tin (blocks, ingots, bars and slabs).

From—	
Straits Settlements and Federated Malay States	15,435
Australia	1,701
Other countries	11,613
Total	28,749

Into the United States.

Totals—	
Zinc ore	23,000
Spelter	207
Tin	50,563
Ferro-manganese	59,254
Ferro-silicon	13,909
All other pig iron	123,201

State Assistance for the Brazilian Vegetable-Oil Industry.—The Brazilian Minister for Agriculture, Industry and Commerce has been authorised by the Government to negotiate with five leading firms for the erection of cottonseed presses and by-product plant in the States of Pernambuco, Parahyba, Ceara, Maranhao, and Piauhy. The Government will advance up to 75 per cent. of the outlay involved, provided that the plant is delivered ready for erection by December 31. The capacity of the cottonseed-oil plant must be at least 120 metric tons per month for small and from 430—600 t. for large works, and provision must be made for the eventual manufacture of soap, etc. Drugs, chemicals, plant, etc. required for the factories will, when imported, be given the same preferential treatment as goods imported for other State-supported enterprises. The five companies are as follows:—Sociedade Algodoeira de Nordeste Brasileiro, Companhia Parahybana do Beneficiamento e Prensegem de Algodao, Companhia Pastoril Agricola e Industrial Piauhyense, Philomemo Gomes Filhos, and Germano Boettcher. A large part of the production will probably go to the South-American markets, but doubtless other world markets will feel the competition.—(*Chem. Ind., Mar.* 28, 1921.)

The Title of "Civil Engineer."—The Institution of Civil Engineers recently attempted to protect the title "civil engineer," but without success, on account of the difficulty of including engineers of high professional standing who were not members of the Institution. Now the Institution is applying to the Privy Council for a supplementary charter to enable it to confer the title "chartered civil engineer" as a recognised mark of professional status.—(*Min. Mag., Apr.*, 1921.)

PERSONALIA.

M. Georges Claude has been awarded the gold medal of the Société d'Encouragement au Progrès.

The readership in electrochemistry in the University of Manchester has been filled by the appointment of Mr. A. G. Lobley.

The "Sir Robert Hadfield Prize, 1921," has been awarded by the Council of the Institution of Mechanical Engineers to Mr. H. Moore for his paper on "A Small Ball-Hardness Testing-Machine."

Mr. J. E. Sears, jr., has been appointed Deputy Warden of Standards in succession to Major P. A. MacMahon, who has retired. Mr. Sears will continue to hold the post of Superintendent of the Metrology Department at the National Physical Laboratory.

Dr. E. F. Nichols has been appointed president of the Massachusetts Institute of Technology. He was formerly professor of physics at Yale University and is now director of research to the National Electric Lamp Association, Cleveland, Ohio. Dr. H. Hibbert, assistant professor of chemistry in Yale University, has been appointed to an associate professorship in applied chemistry. Dr. A. E. Taylor, professor of physiological chemistry in the University of Pennsylvania, and Mr. J. S. Davis, assistant professor of economics at Harvard, have been appointed directors of the Food Research Institute (*cf.* J., 1921, 129 R).

The German Chemical Society has presented to Prof. Dr. Carl Duisberg a silver medallion in recognition of his great services to the Society and to chemical science.

The following academic appointments, etc. are reported from Germany:—Dr. E. Fromm, extraordinary professor of chemistry in the University of Freiburg (Breisgau), to be professor in the medical faculty at Vienna; Dr. A. Wisner to the professorship of chemical technology in the German Technical "Hochschule" in Brünn; Prof. Dr. Binz of Frankfurt to be professor of chemistry in the Agricultural "Hochschule" in Berlin; and Dr. J. Meyer, professor of chemistry in the University of Breslau, to succeed Prof. W. Biltz as professor in the School of Mines (Bergakademie) at Clausthal. Dr. Hermann Ost has retired from the chair of chemical technology in the Technical "Hochschule" at Hannover.

Dr. Henri St. George, one of the best-known chemists and bacteriologists in Eastern Canada, died suddenly on April 1.

Dr. T. Lynton Briggs, who joined this Society in 1885, died on April 3 at Flushing, New York, aged 63 years. He emigrated to America in 1886 and worked in the research department of the General Chemical Co. His father was one of the first to manufacture coal-tar dyes in England.

The death is announced of Dr. J. I. D. Hinds, chemist to the Geological Survey of Tennessee, at the age of 73. Dr. Hinds assisted in founding the American Chemical Society, and was professor of chemistry in Cumberland University and the University of Nashville and Peabody College.

The death is reported of Prof. T. Miyake of the Agricultural College of the Imperial University, Tokyo.

The deaths of the following German chemists and chemical technologists have recently been announced:—Prof. E. Kirchner, a well-known authority on the technology of paper manufacture, on February 14, in his 74th year; Dr. Carl Duttenhofer, one of the leaders of the German explosives industry, on March 15, in his 72nd year; and Dr. Alex. Bauer, formerly professor of general chemistry in the Technical "Hochschule" in Vienna, aged 85 years.

PARLIAMENTARY NEWS.

HOUSE OF COMMONS.

The Budget.

The Budget for 1921–22, introduced by Mr. A. Chamberlain, contained no new pronouncement of importance to chemical manufacturers. As previously announced by him, the excess profits duty, which yielded £219,000,000 in the past financial year, is abolished, but income-tax, corporation tax, duties on beer and spirits, and postal rates remain unchanged. The corporation profits tax gave a disappointing yield of £650,000, instead of the anticipated £3,000,000. No additional taxation is to be imposed. The external debt has been reduced by £117,000,000 to £1,161,560,000, and the only debt outside the United States and Canada is £826,000 in Sweden, which will be paid this summer. Total revenue and expenditure last year were £1,425,985,000 and £1,195,428,000, and for the current year they are estimated at £1,216,650,000 and £1,038,728,000, respectively.—(Apr. 25.)

Postal Rates on Scientific Journals.

Mr. Rawlinson asked the Postmaster-General whether, in view of the importance of scientific journals and the fact that they cost no more to carry than newspapers of equal weight, he would allow scientific journals published fortnightly or monthly to be registered and carried at the same rate as newspapers.

Mr. Pease replied that similar suggestions had often been considered and rejected. The newspaper rate was already unremunerative, and the proposed measure would considerably increase the existing loss. Such an extension could not be restricted to scientific journals and would have to include magazines and other periodicals.—(Apr. 26.)

Gretna Factory.

Replying to Major W. Murray, Sir L. Worthington-Evans said that the future of Gretna Factory depended upon the settlement by the Government of the general policy regarding the national factories. The subject, which raised issues of the highest importance, was under consideration by the Cabinet, and a statement would be made as soon as a decision had been reached.—(Apr. 29.)

Government Laboratory (Salaries).

Answering Major Hills, Mr. Young said that the initial scales for future entrants to the chemical assistants' grade in the Government Laboratory would be £160 10s.—£200 for men and £140 10s.—£180 for women; the latter scale would come into force when any new women chemical assistants were engaged.—(May 2.)

Power Methylated Spirits.

Mr. Young, in reply to Sir W. Pearce, said that the allowance of 3d. per gallon on spirits used in making industrial or power methylated spirits represented the cost of excise restrictions to the home distiller. There was no reason to think that this allowance was insufficient and it could not be amended.—(May 2.)

Rubber Output (Federated Malay Straits).

In a written answer, Mr. Wood informed Major Boyd-Carpenter that proposals for legislation to restrict the output of rubber in Malaya had been submitted, but it had been decided that such a policy would involve financial liabilities which the Federated Malay Straits could not afford and would necessitate undue Government interference. Conditions must therefore be allowed to right themselves.—(May 4.)

Dangerous Drugs Act.

In answer to Mr. Gilbert, Mr. Shortt stated that the Committee on the Regulations under the Dangerous Drugs Act had nearly completed its inquiry. The report was expected shortly, and would be published.—(May 4.)

REPORTS.

Introduction to the Report of the British Mission appointed to Visit Enemy Chemical Factories in the Occupied Zone engaged in the Production of Munitions of War in February, 1919. *Pp.* 10. *H.M. Stationery Office.* 1921. [*Cmd.* 2*d.*].

The first section of this paper gives a list of the factories visited by Brig.-Gen. Hartley's Mission, together with a few notes on the "Interessengemeinschaft." German methods of manufacturing explosives and poison gases form the subject matter of the second. Mr. W. Macnab and Mr. S. I. Levy found that the German methods of making explosives were very similar to those in use in this country, the chief differences arising from the shortage of materials due to the blockade, *e.g.*, plant for making ammonia from nitric acid, the use of paper crêpe in preparing nitrocellulose, and the substitution of glycol for glycerin (which was apparently not very satisfactory). The strong-acid method was employed for manufacturing picric acid, and *m*-nitrotoluene was separated from the mixed mono-isomers by fractional distillation *in vacuo*, thus allowing of the production of relatively pure TNT without later purification. Apart from these two instances, it may be said that the German methods of explosives manufacture, as seen, were not superior, and in some cases were inferior, to those used in the large English national factories. Dr. H. Levinstein and Mr. F. H. Carr were impressed by the fact that the bulk of the plant for producing poison gas had been used before the war in the manufacture of dyestuffs or pharmaceutical products; and also by the way in which the various stages of manufacture had been allocated among the factories according to the suitability of the available plant. The third section summarises the output of initial products, explosives and gases in the factories visited (*cf.* J., 1919, 398 R); the fourth deals with the military importance of the German chemical industry; and in the final part the position, in February, 1919, of the British and German chemical industries is reviewed [*cf.* J., 1919, 285 R, 303 R (Allmand), 408 R, 427 R (J. Allan), 468 R (Carr); and 1920, 47 R (Evans, Walpole)].

Report on the Commercial Situation in Siam at the close of 1920. *By* T. H. Lyle, *H.M. Consul-General, Bangkok. Pp.* 42. *Department of Overseas Trade. London: H.M. Stationery Office.* 1921. *Price* 1*s.* 3*d.*

The bad trading and financial conditions prevailing throughout the world have also affected Siam, and there is little new to chronicle since the issue of the last report (*cf.* J., 1920, 300 R). A Siamese company, the Siam Coal Mining Co., Ltd., has been formed to exploit a concession near Trang, where coal has been found, but some difficulty is expected as the coal will not bunker, being liable to ignite spontaneously after a short exposure. An old-established British company has recently acquired temporary control of one of the tannery undertakings, with option to purchase should the venture prove promising.

The export of teak during the 12 months ended March 31, 1920, was practically double that of the previous year, but rice was exported in smaller quantities owing to the partial failure of the crop. The exports amounted in value to £15,718,170 (£1 = 11·28 ticals), and included:—Rice and rice products, 441,039 tons (£10,911,586); teak, 70,202 t. (£1,189,801); hides, £331,472; stick lac, 1063 t. (£156,430); sapphires and rubies, rough, £234,312; sugar, red, 4272 t. (£155,780); and salt, 62,428 t. (£80,733). Imports were valued at £12,272,967, of which the United Kingdom furnished 17·1 per cent. and the British Empire 74 per cent. Importation of iron, steel and machinery from the United Kingdom is steadily increasing, but Japan is losing ground, except in regard to enamelled goods, of which the imports have doubled. The chief articles imported, together with the percentage furnished directly by Great Britain, were as follows:—Glass manufactures, £64,621 (10 %); china and earthenware, £146,539 (2·4 %); chemicals, £51,384 (31·8 %); copper, zinc, iron, lead, tin and other metals, £86,242 (35·3 %); coal and coke, 15,545 t.; oils, other than petroleum, £126,211; medicines, £188,085 (8·9 %); paper, £252,316 (32·1 %); matches, £209,366; leather and manufactures of, £50,222 (14·4 %); soap, £45,799 (71·2 %). Prospects of improving British trade with Siam appear to be good. The report contains very full statistical tables of imports.

COMPANY NEWS.

LEVER BROTHERS, LTD.

The twenty-seventh annual general meeting was addressed by the chairman, the Rt. Hon. Lord Leverhulme, on April 22 at Port Sunlight. After referring to the good services of Mr. John Gray as vice-chairman, from which position he has retired to become chairman of Messrs. Gossage, of Widnes, and Messrs. John Knight, of London, the chairman commented on the precipitous deflation of prices which had occurred and expressed his belief that prices had now sunk to zero. He then spoke of the company's new capital arrangements (*cf.* J., 1921, 95 R, 134 R) and financial position, stating that the Niger Company had been purchased during the past year for 8½ million pounds, Price's Candle Co. for 1¼ millions, Gossages and Crosfields for 1 million, and John Knight, Ltd., for about half a million, making a total of 11¼ million pounds. Negotiations were entered into with the African and Eastern Corporation, but in view of the entirely changed conditions in West Africa, the scheme agreed upon had been abandoned by mutual consent. All new development work had been stopped.

Trade at present was in a most unsatisfactory state; the home trade of the soap industry had probably suffered less than that of most other industries, but export business was extremely quiet. There was a general slump in West African produce, and the position of the Niger Co. had been made more difficult owing to the mistaken policy of the directors of that company during the half-year prior to the change of control. With a view to supporting their own market, the Niger directors had made purchases of native produce through brokers in the open market, and when the slump came heavy losses resulted; during this time Lever Bros., anticipating the coming fall, were selling forward, and after the fusion of the two companies had been effected it was discovered that their profits on sales at high prices were offset by the losses of the Niger Co. The property acquired from the latter company was extremely valuable, and if it ever became necessary to sell it—which is not contemplated—there would be no difficulty in obtaining a foreign purchaser at a price which would entail no loss to Lever Bros. Prospects for 1921 were bright. Helped by the withdrawal of Government interference and the excess profits duty, there was a great revival in the home trade and the beginning of a revival in the overseas trade.

During the war Lever Bros. and its associated companies (now 158) supplied the Government with over 60,000 tons of glycerin at the controlled price of £59 10s. per ton, compared with £200—£500 per ton paid for the imported product, and it was estimated that the total advantage to the Government of having this large home supply represented a money gain of over £10,000,000. Although by virtue of the production of glycerin, the soap industry was a "key" industry, there was no desire to keep out overseas competition by protective tariffs; absolutely free-trade conditions were to be preferred. For the first time in its history the company had experienced a strike. The employees had recently agreed to a reduction in wages; the total sum disbursed in wages by the parent and associated companies in 1920 was £7,707,031, whereas that paid in dividends to the ordinary shareholders was £456,000. During the period July, 1914, to December, 1920, £3,760,514 had been paid in income tax. In reply to questions, Lord Leverhulme said that the recent issue of debentures was made to reduce the outstanding liabilities, which amounted to about £8,000,000, and that the company's claim for repayment of excess profits duty would be a very heavy one.

Associated Portland Cement Manufacturers, Ltd.—The accounts of this company for 1920 show a record revenue, after allowing for taxation, of £952,531, a sum which includes investments in associated companies, etc. Issued capital amounts to £4,422,040 and debentures stand at approximately £4,000,000. There is a general depreciation fund of £1,050,000 and other reserves amount to £661,000. The dividend for the year is 10 per cent., or 2 per cent. better than for the previous year, and £221,561 is carried forward, against £143,511 brought in. The position and prospects of the cement industry were outlined by the Hon. F. C. Stanley at the annual meeting held in London on April 26 (*cf.* J., 1921, 156 R).

Tharsis Sulphur and Copper Co., Ltd.—Addressing the annual meeting of this company on April 20, in Glasgow, Mr. W. P. Rutherford, who has succeeded the late Lord Glenconner as chairman, attributed the very low prices ruling in the copper market to the existence of an unprecedented amount of scrap material and the general lack of demand. A gradual improvement, however, was to be expected, and the company's mining resources in Spain were ready to meet whatever demand arose for its ores when markets returned to their pre-war activity; but as long as the present stagnation lasted the company would restrict expenditure so far as possible. A dividend of 15 per cent. was passed.

The Salt Union, Ltd.—The annual meeting of this company was held on April 19 at Liverpool. Mr. G. H. Cox, the chairman, in a review of the position and prospects of the salt industry, said that output had been very seriously reduced, the number of pans now working being only 45, compared with 245 a year ago. Thanks to better shipping facilities, the Eastern trade had improved in 1920, no less than 100,000 tons of salt having been delivered to Calcutta, besides 5000 t. to Rangoon. But prospects in the Indian market had darkened owing to the competition of German crushed rock from Hamburg and solar salts from Port Said, Spain, and the Red Sea. No English salt had been shipped for two months, but now a limited business was being done, and prices were more satisfactory. Exports to Japan amounted to 6000 t. in 1920, and recently 18,000 t. had been shipped, in the production of which the Weston Point vacuum plant had furnished 4593 t. of salt in one week. Prospects in Scandinavia and in many other export markets were adversely affected by German competition, which was much helped by the abnormal position of the German exchange. The good export trade in 1920 justified the company in maintaining the dividend of 15 per cent. on the ordinary shares.

TRADE NOTES.

BRITISH.

South African Imports of Chemicals in 1919.—The measure of South Africa's dependence upon other countries for supplies of chemicals and drugs may be gauged from the following table of imports during the year 1919. The third column gives the percentage weights in long tons (or volumes) of the substances obtained from the countries indicated:—

		Quantities.	Countries of origin Per cent.
Acetone, methyl alcohol, wood alcohol..	galls.	8,661	U.K. 24·8, U.S. 30, Canada 45.
Acids:—			
Acetic..	„	1,745	U.K. 34·8, U.S. 27·4, Japan 37·7.
Boric ..	tons	18·8	—
Nitric	„	1·7	—
Phosphoric	„	381	U.S. 92, U.K. 7·7.
Sulphuric	„	7·1	—
Tannic	„	1·9	—
Alkalis (unenumerated)	„	247·3	U.K. 100.
Ammonia, anhydrous ..	„	52·8	U.S. 40·6, U.K. 30·7, Australia 28·6.
Ammonium carbonate..	„	28·5	—
Ammonium nitrate	„	0·6	—
Borax	„	94·6	—
Calcium carbide	„	2,756·7	Can. 84·2, U.S. 5·3, U.K. 2·5, Sweden 3·2 Norway 2·5.
Chloride of lime	„	213·5	U.K. 97·2.
Disinfectants		(386,610)	U.K. 93·6.
Insecticides		(87,127)	U.K. 45·4, U.S. 27·5, Australia 25·3.
Gum arabic	tons	34·9	—
Litharge..	„	26·7	—
Magnesium sulphate	„	69·5	—
Medicinal preparations		(1,096,247)	U.K. 63·2, U.S. 31·6.
Other drugs and chemicals		(1,099,318)	U.K. 67·8, U.S. 18·5.
Opium ..	lb.	896	Turk. 37·5, Ind. 35·7, Persia 23.
Potash compounds	tons	164·4	U.S. 81·2.
Potassium cyanide	„	2·2	—
Soda ash	„	1,439·9	U.K. 79·5, Brit. E. Afr. 19·5.
Soda, caustic	„	1,763·9	U.K. 92·7.
Sodium arsenite	„	426·9	U.K. 50, Austral. 50.
Soda cpds. (unenum.)	„	456·5	U.K. 93·7, U.S. 7·2.
Sodium cyanide	„	1,294·7	U.K. 94·4, Germ. 5·6.
Sodium silicate	„	[illegible]	U.K. 98.

Items in italics are given in values (dollars) only.

By value the United Kingdom contributed about 63 per cent. of the total imports.—(*U.S. Com. Rep., Mar.* 12, 1921.)

Mauritius in 1919.—The sugar industry was very prosperous in 1919, and prices exceeded all previous standards. The high-water mark of production has, however, been reached, as practically all the areas suitable for cane growing are already under the crop, and any increase in production will probably come through improved methods of cultivation and milling. Of the total area under cultivation, 226,091 acres, no less than 175,923 acres was under sugar. Cultivation of aloes fibre declined, and the tendency to plant sugar-cane on land formerly occupied by aloes continued. Increasing attention was paid to the possibilities of growing sisal, and trial plantations were established, but the planters were not enthusiastic. Sugar-cane megass is an excellent paper-making material, but hitherto it has been used as fuel in the sugar factories, and as such its value is only equivalent to that of the fuel it replaces. The value of imports during 1919 was Rs. 47,037,024, of which the United Kingdom supplied 24·3 per cent., compared with 16·3 per cent. in 1918 (rupee = 1s. 4d. at par). Imports of coal, machinery, sulphate of ammonia, and linseed oil from the United Kingdom declined, and the high freight rates drove some of the trade to British possessions, particularly South Africa. The value of imports from the United States and Japan also diminished. Exports were valued at Rs. 127,806,321, of which 75 per cent. went to the United Kingdom; they included:—Sugar, 302,826 metric tons; aloes fibre, 2176 t.; copra, 231 t.; coconut oil, 2411 hectolitres; vanilla, 2995 kg.; and molasses, 103 t. (*cf.* J., 1920, 437 R).—(*Col. Rep.-Ann., Cmd.* 1103–5, *Feb.*, 1921.)

FOREIGN.

Foreign Trade of Japan in 1920.—A comparison of the Japanese trade statistics for 1919 (*cf.* J., 1920, 327 R) and 1920 shows that the value of the total imports rose from £221,692,930 to £238,286,178, and that the total exports declined from £214,084,842 to £198,735,678, the decrease being accounted for mainly by semi-manufactured goods. The values of imported and exported chemical products are given below, together with the percentage increases or decreases over those in 1919, the yen being taken at 2·04s.:—

	Imports, 1920. £	Inc. or dec. over 1919. Per cent.
Sugar	6,142,440	+ 3·5
Salt	1,673,922	– 13·7
Oil-bearing materials	1,691,262	– 21·0
Hides and skins ..	1,975,842	+ 25·3
Rubber and gutta-percha, crude.	1,368,234	– 22·7
Chile saltpetre	2,523,480	+ 78·8
Ammonium sulphate, crude	2,026,944	– 27.6
Oilcake	15,392,718	+ 11·6
Coal	2,031,126	+ 7·1
Ores	1,627,614	– 23·7
Leather	857,208	+ 53·3
Paraffin wax	770,202	+ 9·1
Caustic soda and soda ash	1,185,444	– 20·0
Coal-tar dyes	1,574,778	+ 44·0
Paper-pulp	1,344,870	+ 23·4
Iron, pig, rod, tube, plate, etc...	26,342,112	+ 12·4
Lead, ingot, slab	725,118	– 34·8
Tin, ingot, slab	758,982	+ 7·0
Petroleum	2,169,540	– 1·9
Paper	1,794,282	– 4·6

	Exports, 1920. £	Inc. or dec. over 1919. Per cent.
Starches ..	509,694	– 60·8
Sugar, refined	3,121,592	+ 41·5
Coal	4,610,400	+ 19·9
Oils, vegetable	1,082,628	– 18·9
Camphor ..	506,430	– 37·0
Iron	1,503,684	– 30·6
Copper	1,294,278	– 51·5
Leather manufactures	319,566	– 52·5
Soaps	465,426	+ 4·3
Matches ..	2,002,206	– 13·7
Papers	2,359,056	– 8·9
Cement	1,025,618	+ 53·7
Pottery ware	3,208,512	+ 39·0
Glass, and manufactures of	2,350,378	+ 18·0
Rubber tyres	817,734	+ 12·7

The importation of precious metals increased, in spite of the fact that the unfavourable balance of trade in 1920 was five times as great as in 1919.—(*U.S. Com. Rep., Feb.* 16, 1921.)

Austrian Foreign Trade in 1920.—The foreign trade of Austria for the fiscal year 1920 amounted by weight to 5,479,230 metric tons, of which 1,992,990 t. represented the trade between Austria and Germany. Germany supplied 40 per cent. of the total imports (4,502,170 t.) and took 20 per cent. of the exports (977,060 t.). Certain of the principal imports and exports are given below, in metric tons, for the period July 1, 1919, to June 30, 1920:—

	Imports.	Exports
	Metric tons.	
Coal	2,191,200	—
Celluloid	110	—
Magnesite	—	55,200
Graphite	—	6,880
Glass and glassware	18,500	—
Cement	—	10,600
Pottery	27,700	21,200
Chemical materials and products	43,600	35,320
Dyes, varnishes, and medicines	2,100	—

The total values of the imports from, and exports to, Germany were 13,427 million and 5,419 million kronen, respectively (krone=10d. at par, now about 0·18d.).—(*U.S. Com. Rep., Mar.* 21, 1921.)

Swiss Imports of Chemicals and Oils in 1920.—Importations of chemicals and oils into Switzerland in 1913 and 1920 were as follows:—

	1913. Metric tons.	1920. Metric tons.
Sulphur, lump, etc.	33·88	38·62
Turpentine oil	19·32	17·05
Caustic soda and potash	89·06	115·71
Sulphuric acid	96·11	132·8
Copper sulphate	21·03	8·68
Benzine	160·88	349·2
Aniline	12·02	23·46
Aniline compounds	8·87	15·23
Alcohol, denatured	13·36	15·91
Linseed oil	47·69	20·9
Olive oil, olein	6·27	5·54
Fats and oils, liquid, crude	28·67	9·92
Coconut and palm oil, crude	21·91	18·26
Petroleum	629·42	246·12
Lubricating oil	138·9	122·03
Bone meal, raw phosphates	188·85	187·17
Basic slag	557·93	651·45
Potash fertilisers	132·41	166·31
Other-fertilisers	263·09	167·32

—(*Chem. Ind., Mar.* 28, 1921.)

GOVERNMENT ORDERS AND NOTICES.

Prohibited Exports.—The following have been removed from the list of prohibited exports, as from April 28:—(1) Potash, caustic, and articles containing caustic potash; (2) Potassium carbonate and mixtures containing potassium carbonate.

Orders under the German Reparation (Recovery) Act, 1921.—Order No. 6, dated April 21, excludes from the provisions of the Act articles produced or manufactured in the Saar Basin.

By Order No. 7 of April 28, any article proved to have been delivered by Germany to any Allied or Associated Power by way of reparation is exempted from the provisions of the Act.

Order No. 8, of May 3, exempts any article imported before June 15, 1921, provided it is essential for completing and working machinery or plant partly delivered before March 8, 1921, or is an essential part of German machinery installed in the U.K. before that date; and if patterns, drawings, or designs were sent to Germany before March 8, provided that their value is not less than 20 per cent. of that of all articles to be manufactured under the contract.

Order No. 9, dated May 3, exempts any article sent from the U.K. to Germany, or returned unaltered to the U.K. from Germany, provided that the consignor in the U.K. still retains the ownership.

In Order No. 10, of May 3, sections (a) and (b) of Order 1 (*cf. J.*, 1921, 155 R) are recapitulated, and the date up to which importation is allowed is extended to June 15.

Women and Young Persons (Employment in Lead Processes) Act, 1920.—Draft Orders have been issued by the Home Secretary under Section 2 of the above Act, providing that any women or young persons employed in any process in which dust or fume from a lead compound is produced or in which such persons are liable to be splashed with any lead compound must be examined once in every three months by the district Certifying Surgeon appointed under the Factory and Workshop Act, 1901, and that suitable cloakroom, messroom, and washing accommodation shall be provided. These proposed Orders are based on the requirements in existing Regulations and Orders for other processes.

Emergency Regulations.—By Royal Proclamation of April 30, the state of emergency proclaimed on March 31 and the Emergency Regulations of April 1 were continued.

The supply of coal to breweries and distilleries, except to certain yeast-producing distilleries, has been prohibited.

OFFICIAL TRADE INTELLIGENCE.

(*From the Board of Trade Journal for April* 28 *and May* 5.)

OPENINGS FOR BRITISH TRADE

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W. 1, from firms, agents or individuals who desire to represent U.K. manufacturers or exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department and quoting the specific reference number.

Locality of firm or agent.	Materials.	Reference number.
Australia	Skins, hides, glove leather	*412/20/7/545
British West Indies	Cement, paper	527
„	China	567
Canada	Chemicals	520
„	Gelatin	521
„	Soap, disinfectants, china	524
„	Crockery, china	525
„	Floor oil, washing compounds	†
„	Polishes	564
South Africa	Tinplate	565
„	Window glass, steel plates	566
Belgium	Paper	529
„	Pig iron, minerals, chemicals, cement, glass, china, crockery, paint, varnish, paper, leather	571
Danzig	Edible oils and fats, industrial and mineral oils	529A
France	Copra, groundnuts, oilseeds, crude drugs, hides, skins, tanning materials	532
Greece	Mexican fibre	533
Italy	Crude linseed oil	534
Netherlands	Fertilisers	535
Norway	Chemicals	537
„	Tinplate, steel sheets	538
„	Olive oil, animal fats, sugar, syrup, soap	539
„	Hides	540
„	Technical and edible oils	581
Spain	Chemicals, china, glassware	542
„	Chemicals, pharmaceutical products, colours, paint, varnish, metals, fine earthenware	586
United States	Earthenware, china	546
„	High-grade varnish and enamel	548
Argentina	Earthenware	550
Cuba	Plate and window glass, tinfoil, crown corks	552
„	Paint, varnish	592
Mexico	China	593

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* The Official Secretary, Commercial Information Bureau, Australia House, Strand, London, W.C. 2.

† The Canadian Government Trade Commissioner, 73, Basinghall Street, London, E.C. 2.

Markets Sought.—A Canadian tannery able to export leather for bookbinders and bag makers, wishes to hear from importers in the U.K.

A Canadian tannery able to export 1000 sides per week of chrome leather in black and colours desires to get into touch with U.K. importers.

A firm at Montreal able to export asbestos wishes to hear from importers in the U.K.

[Inquiries to the Canadian Government Trade Commissioner.]

TARIFF. CUSTOMS. EXCISE.

Australia.—Drugs and chemicals, not elsewhere included, when packed for use in the household are dutiable under Item No. 79, and medicines for similar use under Item No. 285.

Austria.—As from April 15, customs duties when paid in bank notes must be paid at 80 times the rates specified in the tariff.

Belgium.—Sulphuric ether may be imported without licence as from May 2.

British Honduras.—The import duty on fuel oil has been doubled, and the export duty on alcoholic beverages reduced.

British India.—The valuations of raw hides and skins for export duty are set out in the issue for May 5.

Cyprus.—The export is prohibited to all destinations of, *inter alia*, chemicals, drugs, oils, copper, silver and gold.

Czechoslovakia.—A copy of the export free list may be seen at the Department, 18, Queen Anne's Gate, S.W. 1.

Denmark.—A "dispensation duty" is charged in connexion with the issue of licences for the import of goods containing sugar. A complete schedule of such duties may be seen at the Department.

Ecuador.—The export duty on ivory nuts is fixed, as from January 1, at 2 centavos per kg. for unshelled and 3 centavos per kg. for shelled nuts. Certain additional export duties are also levied thereon.

Egypt.—Exports to Russia are no longer subject to licence except in respect of goods the export of which is prohibited.

Recent import tariff valuations affect, *inter alia*, copper, brass, tin, lead, zinc, phosphor bronze, antimony, and quicksilver.

France.—The export duty on dephosphorisation slag has been withdrawn as from April 3.

Germany.—Import licences are no longer required for animal manures, and many seeds and condiments.

Export prohibitions have been withdrawn from raw cocoa, lemon juice, certain spices, white of egg, cocoa butter, rice starch, vinegar, certain flavouring essences and chemically prepared foods, etc.

Do. (Occupied Territory).—Not more than 5 kg. of goods (with some exceptions, including pharmaceutical products and synthetic dyes) may be imported by parcel post without licence.

Iceland.—The import is prohibited of chocolate, chinaware, liquorice, and perfumery. The import of almost all other goods is free.

Italy.—Until further notice all goods (with certain exceptions) may be imported by parcel post without licence.

Luxembourg.—All goods may now be exported without restriction with a few exceptions, among which are chemical and natural manures.

Mexico.—The export duty on sugar has been abolished.

Netherlands East Indies.—A copy of the new tariff law may be seen at the Department.

Increased import duties are payable on wares of iron, steel, tin, lead, copper, zinc, leather, and paper.

Modified export duties are payable on mineral oil and by-products thereof, and new duties on rubber, quinine, copra, and coconut oil.

New Zealand.—Export prohibitions have been withdrawn from glue, gelatin, glue pieces, hide pieces, and similar goods for the manufacture of glue and gelatin.

Nigeria.—The import duties on spirits have been increased.

Norway.—Export prohibitions have been withdrawn from certain hides and skins, leather, and pyrites.

Paraguay.—The import duties on starch, creolin, matches, common soap, and candles have been modified.

Rumania.—The export is prohibited of caustic soda, copper, brass, flax, flaxseed, grease, iron ore, pyrites, lard, animal fats, paper, paraffin wax, crude petroleum, petroleum residues, and zinc.

Special authorisation is required for the export of bones, cellulose, cement, ferromanganese, old iron, tarred paper, petroleum products not specified above, and shoemakers' glue and starch.

South Africa.—The import duties on beer and spirits have been increased.

Spain.—The export is permitted without restriction of all kinds of paper, cardboard and pasteboard.

The restrictions on the export of certain hides and skins have been relaxed.

The surcharge of customs duties when paid in Spanish silver or notes of the Bank of Spain is fixed for the month of May at 37·79 per cent.

Sweden.—Export prohibitions have been withdrawn from certain oilcakes and cattle foods.

A copy of the regulations affecting the testing of leather substitutes may be seen at the Department.

It is proposed to increase the customs duties on china, earthenware, glass, iron and metal goods.

Tunis.—Export prohibitions have been withdrawn from essence of turpentine and celluloid.

REVIEWS.

Factory Administration and Cost Accounts. *By* Edward T. Elbourne. *New edition. Pp.* xx.+ 811. *(London: Longmans, Green and Co.* 1921.) *Price* 45*s. net.*

One of the most interesting developments of recent years has been the attempt to place factory costs and management on a scientific basis. Just as in the chemical industry there has been a constant progress in the replacement of "rule of thumb" and empirical methods of manufacture by those based on exact knowledge, so in other branches of industry has there been an endeavour to replace rough estimates by accurate costings and to base management more on known statistical figures than by observation—more or less cursory—of the work in hand. There has been, moreover, a marked contrast in the progress of various industries, for while the engineering and heavy chemical trades have been firmly established, the dyestuff and fine chemical industries are still in the embryonic stage. In engineering the systems of costing and of factory control have been developed to a state of great efficiency, but only recently has the value of chemical control of material begun to be recognised. In the chemical industry the converse is possibly true, for there, after years of propaganda, the value of research and laboratory control is well established and extensively practised, but the vital necessity of accurate costings and the value of scientific management is but just beginning to be realised. Although the principles of control, chemical or otherwise, of experiment and research, of costing and of management are the same, whatever may be the industry, there is a great difference in their application. Thus, in engineering, labour is the all-important item, and material costs are small in comparison, as, for instance, take the cost of a £1000 motor car and contrast the value of the metal used and of the labour involved: whereas in the chemical industry the value of the material employed is often many times that of the labour. This results in a different outlook in the two industries. In engineering, labour costs and rate of production are the factors most eagerly scrutinised, whilst in chemistry yields play the most important part in factory cost. Again in regard to expenses, whilst many are common to both industries, in engineering the cost of machinery and its output may be contrasted with the laboratory and supervision expenses in the chemical industry. It follows that though both the engineers and the chemists are agreed on the principles of costing and management, the application of these will be different in each case, and not only will they differ in each industry, but in each particular branch.

The chemical manager, therefore, who wishes for information on these important points can only expect to find general principles in the literature available, and must be prepared to work out the particular application suited to his works. He will be in much the same position as he finds himself with regard to his own science, for whilst he can get certain information from published chemical literature, he must amplify this and work out his methods in his research and technical laboratories and his own drawing office. With a recognition of these factors, many chemical managers welcomed the appearance of the first edition of "British Factory Administration and Accounts" in 1914, and will turn eagerly to the 1921 edition* to see what help in their industry they may derive from it. The author of these books has had great experience in some of the largest engineering undertakings in the world, and therefore speaks with authority on the practice in this industry, but the chemical manager will turn to the book to select those systems which can be successfully applied in his own particular works.

The preface promises well, emphasis is laid on the fact that the book deals essentially with principles and that practical applications are given by way of illustration; this underlying idea of the work is fully in keeping with the remarks previously made. It is also clear that the book is intended as one for reference. In this review it is intended to consider it from the standpoint of its value to one in charge of a chemical works. It consists of over 700 pages, with an excellent index of 60 pages. These are divided equally (approximately) into Works Management and Works Accounting, and the subjects are dealt with most exhaustively from an engineering point of view. The greater portion of the work, unfortunately for the chemical manufacturer, is occupied with the illustrations rather than by a discussion of principles, and these illustrations will, it is feared, prove of very limited application in the management of chemical works. It is proposed, therefore, to deal with these principles rather than with details of forms and methods specially applicable to engineering; also to consider the subjects as they are divided in the book itself.

1. *General Administration.*—There is very little in this section which will be helpful to the manager of a chemical works, though here and there items of interest crop up; for example, on page 18 the question of buying material is entirely looked at from the engineering standpoint, whereas in a chemical works the quality of the article very often determines its price and certainly its value to the manufacturer. On page 64 there is a very interesting statement regarding the relation of works expenses to direct wages, which is worth the careful attention of all concerned. The fallacy of using a ratio of works expenses to the direct wages bill as a measure of the efficiency of management is pointed out. It may be remarked that in a perfectly organised works where machinery is used to such an extent that the amount of direct labour is practically negligible, the proportion of expenses to direct labour would be enormous and, to the uninitiated, might excite the utmost alarm as to the efficiency of the management. There is a great deal of useful and general information in this section to those dealing with the administrative side of the business, such as sales, organisation of the office staff and legal points relating to the question of insurance, etc.

2. *Works Management.*—Divided into three sections of Production, Labour, and Material Control.

Production.—This section is a chapter of 12 pages relating to buildings and plant. It might very well have been extended, as it is a subject of very general interest, whereas the other chapters relate almost entirely to conditions existing in the engineering trade. The section on buildings and plant is so essentially a question in which every manufacturer is interested that it is a great pity it was not further elaborated.

Labour Control.—The relation of engineering employers with their employees and of the unions concerned has been developed to such an extent that the chemical trade will be very glad to obtain from them all the information possible, and therefore this section on labour administration will prove of very great interest to the chemical works manager, and will also prove most valuable for the purpose of reference. It is certainly one of the most useful sections in the book.

Material Control.—This section deals with the methods used in the engineering industry, and will prove but of very limited use to those engaged in the chemical industry.

3. *Works Accounting.*—Divided into two sections:—(a) Administration Records, (b) Cost Accounts, followed by specimen forms of works routine, with a complete index.

(a) *Administration Records.*—This is an extremely important section, and its relation to the all-absorbing question of cost accounts is well defined. In contradistinction to the earlier part of the work, this section is of general interest, and will well repay careful study by all concerned in factory management and accounting. It contains a full account of matters of importance to every factory, such as employment records and methods for the accurate keeping of all acounts relative to wages, stock and plant, as well as much valuable information as to stocktaking and depreciation and valuation of plant. Whilst the portion relating to depreciation is more particularly devoted to engineering, the whole section contains such a mass of general information that it will prove of the utmost service as a guide to what should be done in organising or reorganising a works, as well as a useful reference book on these subjects. The importance of accuracy in these matters, if a satisfactory costing system is to be installed, is brought out in the next section dealing with cost accounts.

(b) *Cost Accounts.*—It is not sufficiently recognised that accurate factory costs are essential to success. The result of a business run without these is that the owners do not know how they stand until their final yearly balance-sheet is made out; on the other hand, with an accurate costing system, although they may not know exactly how they are placed until the final balance-sheet is drawn up, they can form a fairly accurate opinion as to the way things are tending all through the year. Such a system to be a success, however, means close cooperation between the business and technical managers and the accountants, and it costs money which, because it does not show direct results, is often begrudged by short-sighted proprietors. Consequently, Section VI. A. is of vital importance to proprietors, or the financial management, as well as to managers and accountants.

When we come to the section dealing with cost allocation, the peculiar nature of the chemical industry becomes apparent. Yields, which play so vital a part in the chemical factory costs, are not a factor in engineering, and so do not come within the scope of this book, but much useful information will be gleaned from the section on cost allocation, though the succeeding sections on standing orders, departmental or intermediate process accounts, and stock production account will be of limited value or interest to trades other than engineering. The section on oncost or expenses, as we prefer the term, is, on the other hand, of importance to all concerned. The fact that interest on capital and depreciation is a logical part of expenses is emphasised as it should be. Here again, however, the chemical manufacturer will have to apply the information to his own particular needs. To mention one instance, the amount and value of steam used in chemical operations is a considerable part of the expense, but finds no mention or application as applied to engineering costs.

The chapter on works routine—specimen forms—gives a mass of information—150 pages—in the nature of forms which are, however, of little interest to those not engaged in engineering, though useful for the purpose of reference.

Looking at the book as a whole, the impression forced upon the chemical manufacturer, and probably upon all but those engaged in the engineering trade, is that it contains an immense amount of information; that parts of it will prove at once of use to those in other than the engineering industry, and that to those who have the time and patience to read it through carefully there are many pages which, although they deal directly with engineering, will give food for thought and may perhaps give rise to ideas in the particular industry in which the reader is engaged.

The book is well printed on good paper (medium 8vo) and full cloth bound. It is published at the not extravagant price, at the present time, of 45s. net.

H. A. D. Jowett.

A Research on the Eucalypts and their Essential Oils. *By* Richard T. Baker *and* Henry G. Smith. *Second edition. Pp.* xv.+471. *Published by authority of the Government of the State of New South Wales, Sydney,* 1920.

Since the time of Baron von Mueller the systematic study of the Eucalypts has been almost entirely in the hands of Baker and Smith. These authorities have departed from purely orthodox methods in classification and have founded species on a system depending not only on morphological characters, but have called to their aid, *inter alia*, the chemical properties of the products of the trees. The system that has been adopted appears to have worked out very successfully.

In the volume under review, which is enriched with numerous beautiful illustrations, the whole of the important Eucalypts are fully described. Information is given concerning the botanical characters of the tree, its habitat, the character of its timber, and a full account of its essential oil.

A special chapter is devoted to a description of the principal constituents found in the Eucalyptus oils, including cineol, geraniol, the terpineols, piperitol, eudesmol, cuminal, aromadendral, and cryptal. A critical survey of the methods for the determination of cineol in eucalyptus oils is included, but the *ortho*-cresol method has, unfortunately, been published in this country just too late to be included in this survey. The authors conclude:—(1) That an accurate method for determining the amount of cineol in eucalyptus oils under all conditions has yet to be discovered; (2) that no one present method is applicable in all cases; (3) that arsenic acid is less advantageous for the purpose than phosphoric acid; (4) that the use of petroleum ether in connexion with phosphoric acid is an advantage if the process be carried out in the manner suggested by the authors.

Among other conclusions they agree with most English chemists that the resorcinol method is only of use with certain types of oil. It is stated that eudesmol occurs in both the liquid and the crystalline conditions, "although the line of demarcation separating them is evidently slight." The authors consider that eudesmol changes its character from crystalline to liquid, and *vice versa*. The explanations of this do not appear to be very satisfactory, and it is probable that further research may prove the existence of isomeric eudesmols, each of constant characters and existing in varying proportions naturally, so that superfusion and similar phenomena may be in question.

Cryptal is a new aldehyde of some interest, and was obtained from two different specimens as a crystalline semicarbazone, melting at 180° C.; there appears to be no doubt of its chemical individuality. Piperitone, the "peppermint" ketone discovered by Smith, is another very interesting constituent of certain Eucalyptus oils, and interesting speculations as to its constitution are made. It is possible that thymol, which results from the oxidation of piperitone by means of ferric chloride, may eventually be prepared in this way on a commercial scale.

The work is very free from errors, and reflects great credit on all concerned in its production.

Ernest J. Parry.

The Technical Examination of Crude Petroleum, Petroleum Products, and Natural Gas. *By* W. Allen Hamor *and* F. Warde Padgett. *Pp.* x.+573. *(New York: McGraw-Hill Book Co., Inc.* 1920.) *Price* 30*s. net.*

This work, primarily written for American students of petroleum technology, will prove of service to all those interested in the examination of petroleum products. The authors have attempted, with success, to compress into a small space the latest physical and chemical methods considered essential for the evaluation of crude petroleum and its derivatives. In order to do this other well-known text-books on the subject have been widely quoted, and the authors have not failed, where they have considered it expedient, to cut out details and satisfy all requirements by referring to the source where such details can be found. Unlike inorganic analysis, the analysis of petroleum bodies depends largely upon empirical methods, carried out according to standard methods in order to obtain comparative results. In such cases the authors have adhered to American methods and have chiefly described those prescribed by the American Society for Testing Materials and the United States Bureau of Standards. For this reason the Redwood viscosimeter is mentioned but not described. The multiplicity of methods now used for reaching the same objective only emphasises the urgent necessity for the early international standardisation of methods in order to save time and prevent confusion.

In addition to chapters on the examination of crude petroleum, illuminating oils, lubricating oils and greases, and bituminous road materials there are valuable chapters on the examination of other petroleum products, the sampling of petroleum oils, the evaluation of oil shales, laboratory methods for benzol-recovery plant operations, and the examination of natural gas. In view of the increasing importance of benzol and the world-wide interest now taken in oil shale, the inclusion of these two chapters adds to the value of the volume. For the latest information on the "Laboratory Testing of Oil Shale for Oil and Ammonia Yield," the paper by Lawson Lomax and Remfry, in the *Journal* of the Institution of Petroleum Technologists, Vol. 7, Jan., 1921, should be consulted.

The descriptive matter in the book occupies circa 300 pages, and the remaining 272 pages are closely packed with an exhaustive appendix containing in compact form chemical and physical data and many valuable specifications for the reference of the refinery chemist, petroleum engineer, and gas engineer. The authors have not failed to give consideration to that very important item in a book of reference—the index—and to emphasise their appreciation of this feature they quote the following from Horace Binney:—"The best book in the world would owe the most to a good index, and the worst book, if it had but a single good thought in it, might be kept alive by it."

The thought underlying the structure of this work is so good that its continued appearance as a standard handbook on the subject in its present form is to be expected. There is no doubt that the analyst or petroleum technologist in possession of this book has at hand a reliable work of reference, and with the methods described and those referred to is in a position to carry out all the essential tests on petroleum products.

M. B. Blackler.

OBITUARY.

J. W. LEITCH.

John Walker Leitch, who died on April 10, was born at Paisley, in 1865, and was educated at the Royal College of Science, South Kensington, and at the University of Glasgow, where he took the B.Sc. degree. In 1887 he came to Milnsbridge, near Huddersfield, as secretary and chief chemist to Messrs. Dan Dawson Bros., Ltd., one of the pioneers in the colour-making industry. In 1890 he started business on his own account and shortly afterwards established the present firm of Messrs. John W. Leitch and Co. at Milnsbridge Chemical Works. Throughout his career Leitch devoted himself to the manufacture of coal-tar products. Specialising on the nitro- and amino-derivatives of benzene and toluene, he established a standard of excellence in the intermediates and colours which he manufactured that was not bettered even by the Germans. Not only have the effects of his work been felt in the colour industry, but also in the heavy chemical trade and in the field of explosives manufacture, where his intimate knowledge of the aromatic nitro-compounds proved of great value. Leitch held numerous patents covering improvements to processes and to plant, particularly in respect of the recovery of sulphuric acid from waste acid, plants to his specification having been installed in numerous works. Years before the war he developed the manufacture of dinitrotoluene for dye-making, incidentally obtaining TNT, and extended the production of the latter in the early period of the war, producing an almost perfectly pure product. He gave unstintingly of his energy to assist the Authorities in the manufacture of explosives, and as the result of his exertions on war work he suffered a very serious breakdown in health in 1917, which lasted for twelve months, and from the effects of which he never completely recovered.

Leitch was first president of the Chemical Employers' Federation (Yorkshire Section), an active member of the Association of British Chemical Manufacturers, and was keenly interested in the improvement of facilities for higher technical instruction in Huddersfield, where he was a member of the Technical College Coal-Tar Extension Committee. He was chairman of the Board of Trade Commission that visited the German colour works in the occupied territory, and reported on their condition shortly after the armistice was signed. A member of this Society since 1894, he was until recently a regular attendant at the Society's annual gatherings.

L. G. Paul.

PUBLICATIONS RECEIVED.

Famous Chemists: The Men and their Work. *By* Sir William A. Tilden. *Pp.* 296. (*London: George Routledge and Sons, Ltd.; New York: E. P. Dutton and Co.* 1921.) *Price* 12*s.* 6*d.*

Oils, Fats, and Waxes and their Manufactured Products. *By* C. R. Alder Wright *and* C. A. Mitchell. *Third edition, revised and greatly enlarged.* *Pp.* 939. (*London: Charles Griffin and Co., Ltd.* 1921.) *Price* 56*s.*

Tables of Refractive Indices. Vol. II. Oils, Fats, and Waxes. *Compiled by* R. Kanthack, *edited by* J. N. Goldsmith. *Pp.* 295. (*London: Adam Hilger, Ltd.* 1921.) *Price* 25*s.*

Technical Methods of Analysis. *By* R. C. Griffin. *Pp.* 666. (*New York and London: McGraw-Hill Book Co., Inc.* 1921.) *Price* 33*s.*

Metallic Alloys: their Structure and Constitution. *By* G. H. Gulliver. *Fourth edition.* *Pp.* 439. (*London: Charles Griffin and Co., Ltd.* 1921.) *Price* 15*s.*

The Clayworker's Hand-Book. *By* A. B. Searle. *Third edition, revised, enlarged, and largely rewritten.* *Pp.* 381. (*London: Charles Griffin and Co., Ltd.* 1921.) *Price* 21*s.*

The Extra Pharmacopœia. Vol. II. *By* W. H. Martindale *and* W. W. Westcott. *Seventeenth edition.* *Pp.* 688. (*London: H. K. Lewis and Co., Ltd.* 1921.) *Price* 17*s.* 6*d.*

Laboratories, their Planning and Fittings. *By* A. E. Munby, *with a historical introduction by* Sir A. E. Shipley. *Pp.* 220. (*London: G. Bell and Sons, Ltd.* 1921.) *Price* 25*s.*

Drugs in Commerce. *By* J. Humphrey. *Common Commodities and Industries.* *Pp.* 116. (*London: Sir Isaac Pitman and Sons, Ltd.* 1921.) *Price* 3*s.*

Kolloidchemie der Eiweisskörper. Part I. *By* Prof. Wo. Pauli. *Pp.* 111. (*Dresden and Leipzig: Th. Steinkopff.* 1920.) *Price: paper,* 10 *mk.*

Die Physikalische Chemie in der Inneren Medizin. *By* Prof. H. Schade. *Pp.* 569. (*Dresden and Leipzig: Th. Steinkopff.* 1921.) *Price: paper,* 21*s.*, *bound,* 23*s.* 10*d.*

Festschrift aus Anlass des Siebenzigsten Geburtstages von Cornelio Doelter. *Edited by* H. Leitmeier. *Pp.* 96. (*Dresden and Leipzig: Th. Steinkopff.* 1921.) *Price: paper,* 12 *mk.*

Vorlesungen über Chemische Technologie. Band II, Organischer Teil. *By* H. Wichelhaus. *Fourth edition, revised and enlarged.* *Pp.* 447. (*Dresden and Leipzig: Th. Steinkopff.* 1920.) *Price: paper,* 40 *mk.*, *bound,* 45 *mk.*

AMMONIA OXIDATION AT HÖCHST

J. R. PARTINGTON.

The ammonia oxidation plant of the Höchst Farbwerke (vormals Meister, Lucius und Brüning) is situated at Höchst, on the right bank of the Main, about 10 miles from Mainz. It is about two miles from the works of the Griesheim-Elektron Co., with which, however, it has no connexion. During the war an amalgamation with the Badische interests took place, synthetic ammonia from Oppau being supplied to Höchst for oxidation (*cf.* J., 1921, 99 R). There was before the war an oxidation plant at Höchst, comprising 37 converters fitted with circular platinum gauzes about 7·2 in. diameter, contained in vessels similar to those used for contact sulphuric acid. The efficiency of this plant, which produced about 54,000 tons of nitric acid per annum, was not above 80 per cent., and a new plant, completed in February, 1919, was erected in its place at a cost of about £1,000,000. This plant has a capacity of 24,000 tons of ammonia, or 140,000 tons of nitric acid, per annum.

In addition to synthetic ammonia, arriving as 25—27 per cent. liquor from Oppau, gas liquor ammonia (20 per cent. NH_3), and cyanamide ammonia liquor (22—27 per cent.) from Knapsack (*cf.* J., 1919, 303 R) were received, the liquor being stored in four overhead spherical steel tanks, each of 264,200 gallons capacity. The liquor was rectified in four stills, one spare, of the Savalle type with 15 effects, each with a capacity of 20 tons of ammonia daily. The gas not used for oxidation was absorbed in a plate tower 30—40 ft. high. Ammonia from gas liquor was scrubbed with caustic soda solution of 48—53° Tw. and then passed through charcoal purifiers in the usual way to remove sulphur compounds. The ammonia gas from the stills was freed from moisture by refrigeration with ice-cold water; the presence of moisture caused scaling of the iron pipes and was also believed to be prejudicial to the conversion, although there is no evidence of this.

The ammonia gas and air were metered through Venturi meters and driven by ten 55 kw. centrifugal blowers to the filters and converters. The mixture contained 12·5 per cent. by volume of ammonia, regulated within narrow limits. The ammonia supply pipe was 6 in. diameter and the air pipe 18 in. diameter. The air was filtered through cloths in a wooden box and the mixed gas was carefully filtered from dust and ammonium salt fumes through eight layers of linen cloth in chambers 9 ft. by 5 ft.

The gas passed under 6 in. water pressure through two central mains in the converter house, from which it was diverted to the 224 converters, each provided with a circular platinum gauze catalyst of 20 in. diameter, or 2·12 sq. ft. cross section. The maximum output of each converter was 1·5 tons of nitric acid per 24 hours, the efficiency of oxidation being 89 per cent. The efficiency from ammonia to dilute acid (including the efficiency of the absorption plant) was 87 per cent.; that from ammonia to strong acid (including the concentrating plant) was 84 per cent. The body of the converter (Fig. 1) consists of cast iron, in four sections with flanges. The two middle sections were 18 in. and 12 in. high, and supported the catalyst between them; the conical top and bottom pieces were each 3 ft. 6 in. high. The top cone was lined with sheet nickel to protect it from the hot gas. The catalyst, clamped between asbestos rings, was started by heating to redness by a hydrogen or coal-gas flame inserted below it through a lighting hole shown in the figure.

The exact construction of the catalyst has been differently stated. It has been asserted that it consists of two, or three, or four platinum gauzes, 20 in. diameter, of 0·06 mm. wire with 80 meshes to the linear inch. The gauzes are possibly spot-welded and are supported on a grid of ten stout platinum wires, 1 mm. diameter, spaced at 10 cm. distance. The total weight of platinum in the catalyst has been stated as 333 grams, which does not agree very well with the details of construction, but is probably approximately correct.

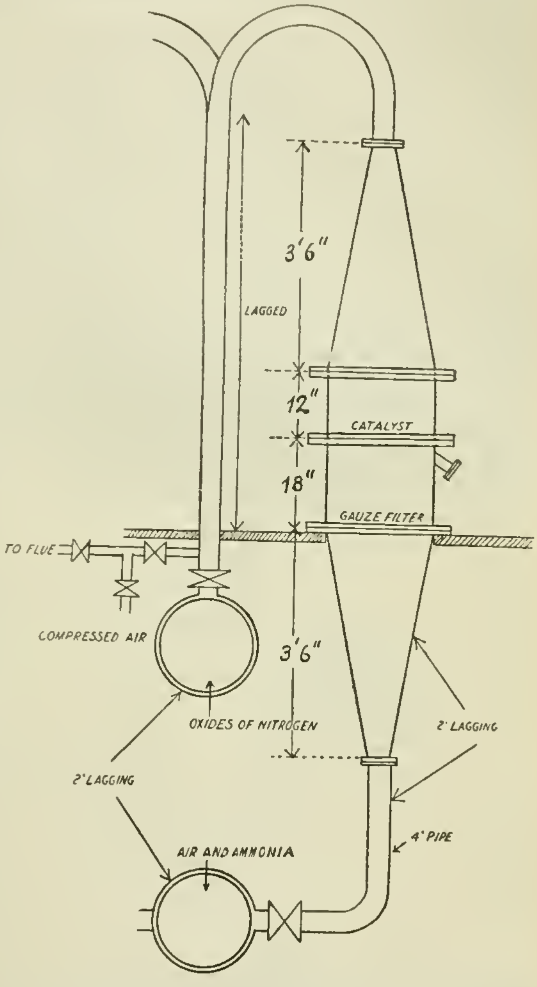


Fig. 1.

The converters were arranged in two sets of seven or eight on each side of separate inlet and outlet mains, the latter 1 ft. in diameter and connected with the converters by 4 in. pipes, lagged with diatomite brick shaped to fit, cemented and wired. The upper bend pipe of the converter was not lagged, so as to allow for expansion. Before entering the converters the gas passed from a common main to a vertical, lagged, multitubular pre-heater, 15 ft. by 5 ft. external dimensions, in which it was heated by steam. The purpose of this was to prevent condensation of acid from the hot gases coming from the converter when these were passed through the heat-exchanger which followed. In this, which was identical in dimensions with the pre-heater, the warmed gas passed in counter-current to the gas from the converters, and left at 200° C. Two heaters so arranged served 14 converters. The temperature of the catalyst was about 800° C.; the gas left the converter at 650—700° C. In starting the converters extra air could be added and the only partly converted exit gas by-passed to a chimney until the gauze was activated. Gate valves were used, with a slight air pressure on the side of the valve not in contact with the gases to prevent leakage. In 56 of the latest type of converters the gas was passed by a lagged 3 ft. main through two tubular boilers, leaving these at 270° C. to the heat exchanger. In this way four tons of water was evaporated per hour and the steam was used for warming the gas, as described above. From one to three men only are necessary to attend to all the converters.

The gases containing nitric oxide and steam coming from the converters were passed through eight cast-iron mains 18 in. diameter, supported on three ferro-concrete bridges, to four rows of eight absorption towers. Each row of towers was provided with twelve intensive coolers of special design, *i.e.*, 48 coolers in all. These coolers (Fig. 2) were of aluminium, with an annular space between the outer wall and an inner vessel, the gas entering above through a 4-in. inlet, dividing into four 2-in. pipes leading to an annular space between the walls. The gas and condensate left through a 4-in. outlet below. The coolers are 5 ft. high and 2 ft. 6 in. diameter. In these, on account of the rapidity with which the gas passed through, practically no acid was condensed, but only water. The condensate was put down the fifth absorption tower. The gas left the set of 4 coolers at 30° C. through 4 pottery mains 1 ft. diameter, joining to a single brick chamber at the base of each set of eight towers attached to 56 converters. Secondary air was admitted at this point (not before the coolers).

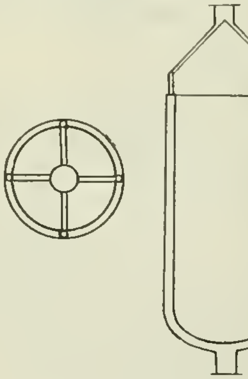


Fig. 2.

The towers are 41 ft. high and 21 ft. diameter internally. The walls comprise three layers of brickwork, the outer layer of bricks 6 in. by 4 in., set in a mixture of sodium silicate and kieselguhr. The top of the tower is slightly domed, and there is a central partition in each tower, the gas passing up one side and down the other, and then going to the next tower through a brick channel at the base. The towers are packed with stoneware rings. The total internal volume of all the towers is 35,320 cb. ft., which amounts to only 81 cb. ft. per lb. NO_2 absorbed per minute as compared with 350 cb. ft. calculated by the formula proposed by Dr. Parker and the writer (*cf.* J., 1919, 75 T), or 1500 cb. ft. as used at the French works at Bassens when we saw it in 1918. The reason why this small tower capacity is effective is clear when it is remembered that at Höchst no less than 25 per cent. of the oxides was absorbed as nitrate by saturated sodium carbonate solution fed to the last two towers. The liquor in the first of these towers is allowed to become acid, so that the nitrite is converted into nitrate, whilst that in the second is kept alkaline, to absorb the oxides of nitrogen driven out of the first when conversion into nitrate occurs (see B.P. 129,699/1919; Partington and Rideal). The solution of nitrate was evaporated by the waste heat of the converters. The remaining towers were fed with water for the production of nitric acid. The efficiency of absorption plant was 97 per cent. Each tower is stated to have cost 40,000 marks. Acid of 50 per cent. strength was obtained from the first tower of the series, the liquid being circulated in the towers by 8 in. chrome steel centrifugal pumps each fed by a 3—4 in. pottery main and delivering through a silicon-iron pipe of the same diameter to the top of the tower, two delivery pipes being used to each tower. The metal pipes were coned and fitted in the same way as the pottery pipes. Acid distribution was effected at the top of the tower by a revolving ribbed disc, turned by a gear shaft at 80 revs. per min.

The acid from the towers was passed to the coolers, consisting of S-pipes of silicon-iron cooled externally with water. There were also intercoolers between each pair of towers except the last, and the temperature was kept as low as possible, 25° C. in winter and 40° C. in summer. The fact that the dilute acid towers would probably work slightly better if warm (see Partington and Parker, *loc. cit.*) does not seem to have been appreciated. In summer ice-water was used in the coolers. Large stoneware receivers were placed above the coolers to serve as acid reservoirs. The circulation in each tower was 110 gallons per min.; the loss of acid in the whole system did not exceed 2 per cent.

Twelve stock tanks of brickwork, each holding 1412 cb. ft., received the tower acid from the receivers at the base of the towers, through tapered pottery pipes. No fan was used with the towers.

The tower acid was concentrated by mixing 7 parts of 50 per cent. tower acid with 1 part of sulphuric acid, in five mixing vessels with mechanical stirrers and then denitrating. About 42,000 tons of sulphuric acid was used per month, but practically all was recovered. (In France 2·5 to 3 parts of sulphuric acid only were used, but the nitric acid obtained was less concentrated—85 per cent. strength—than that obtained at Höchst. The nitric acid was recovered partly in two rows of nine silicon-iron towers, 4 ft. diameter and 25 ft. high, and partly in stone towers, with cast-iron pipe jackets, 35 ft. high and 3 ft. 6 in. external diameter, the walls being 9 in. thick. Steam at 150° C. was introduced at the base by a 1 in. lead pipe just above the exit for the denitrated acid. The nitric acid vapour from the top of the denitrator passed to a cooler of S-shaped silicon-iron pipes. The acid to be denitrated entered half-way down the cooler and acid from stock was sent down the upper part to assist condensation. Oxides of nitrogen were removed from the nitric acid by a current of air and recovered in 20 absorption towers. The completely denitrated sulphuric acid was cooled in a water-cooled cast-iron cooler and collected in a large lead-lined tank of artificial stone. It contained about 70 per cent. sulphuric acid and was reconcentrated in a Kessler apparatus or in a modified Pauling apparatus (*cf.* J., 1920, 656 A). The latter was said to be very efficient. (In French practice a denitrating column 20 ft. high and 18 in. internal diameter produced 6 to 8 tons of nitric acid per day with an overall yield of 85 to 87 per cent. on the ammonia burnt in the Ostwald type catalysts. The consumption of fuel in reconcentrating the sulphuric acid was 15 to 20 per cent. of the weight of nitric acid produced.)

It is of interest to compare the mode of operation at Höchst, representing the latest German practice, with the indications obtained by experimental work in England, unfortunately never translated into technical practice. The resemblance is striking. In the following comparison the experiments carried ont by the writer and his colleagues for the Munitions Inventions Department are referred to, many of which have not been published. The separation of water from the converter gas by rapid cooling was the subject of B.P. 131,942/1918 (Rideal and Partington). The object of this procedure, which is combined with the addition of secondary air *after* the coolers, is to keep the gas as concentrated as possible in the oxidation and absorption towers. It is clear from the equation $4NH_3+5O_2=4NO+6H_2O$, that the uncooled converter gas contains nitric oxide and steam in the ratio 2 to 3 by volume, so that if the steam is removed a considerable concentration in oxides of nitrogen results.

The dimension of the platinum wire and the mesh of the gauze are also those found most suitable by the writer, and if the use of two gauzes at Höchst is the correct description this is also in agreement with the type of catalyst recommended in the official publication, "Ammonia Oxidation applied to Vitriol Chamber Plants," M.I.D., Stationery Office, 1919. The use of alkali to finish the absorption was carried out exactly in the manner specified in B.P. 129,699/1919 (Rideal and Partington); it has been shown that this effected a considerable economy of tower space. The use of sulphuric acid as an absorbent, which was tried at Leverkusen and found unsatisfactory, was also the subject of a long series of experiments (unpublished) by the writer and Dr. Parker, who decided that it was not an efficient method of absorption.

It may fairly be said that laboratory workers in England and Germany seem to have been led to the same conclusions, but whereas the German technologists translated the results into plant the English work finished in the research laboratory.

YEAST GROWTH.

LEWIS EYNON.

The growth of yeast, first closely investigated by Pasteur, has since been the subject of much research and controversy. In suitable media, such as malt wort, the growth is characterised by three phases, viz.:—(1) the quiescent, or lag phase, observed when old yeast cultures are introduced into fresh wort, (2) the logarithmic phase or period of unrestricted growth, and (3) the phase of retarded growth due to exhaustion of oxygen or food, or to accumulation of carbon dioxide and other toxic substances. The yeast crop finally obtained is obviously dependent on the various factors which retard growth. It is shown by Dr. A. Slator (Chem. Soc. Trans., 1921, **119**, 115) that if yeast is grown under such conditions that only one of these factors comes into play, it is possible to determine the influence of the individual factors on the yeast crop. Thus, provided the ratio of the constant of growth, K, to the fermentative activity of the yeast, F, is constant, the yeast crop should be approximately proportional to the initial concentration of the sugar when this constituent of the medium is made the limiting factor (*cf.* J., 1919, 392 R). The proportionality was tested with a wild yeast of the *S. ellipsoideus* type grown in a fermented wort that had been freed from alcohol and treated with small quantities of glucose; direct proportionality between yeast crop and initial glucose concentration was found to hold up to about 1 per cent. of sugar, 3900×10^6 cells being produced per 1 gram of sugar fermented. It is further found that with sugar as the factor controlling growth the yeast crop (*S. cerevisiæ* grown in wort) is practically independent of the fermentation temperature between 10° and 25° C., as should be the case since the temperature coefficients of K and F do not differ greatly. The influence of the amount of seeding on the yeast crop is *nil* provided that actively growing cells are used for seeding, *i.e.*, the crop is the sum of the seeding and the growth, the latter being constant. The retarding influence on growth of carbon dioxide remaining dissolved in the wort is very marked and is not attributable merely to exclusion of oxygen. With regard to the influence of oxygen on yeast growth, Slator has attempted to verify the opinion that malt wort contains a certain amount of combined oxygen available for yeast growth (*cf.* J., 1919, 392 R) by estimating yeast crops under such conditions that the oxygen-containing substance would become the limiting factor determining the crop. His experiments, however, do not bear out this opinion, but suggest that there are two different modes of growth of yeast, one of which is illustrated by the initial stages of growth in malt wort, and the other by growth in lactose-yeast-water. In the former, oxygen (either free, combined, or absorbed by the yeast) plays no part save that in the free state it slightly retards growth, carbon dioxide retards growth, and the energy necessary for growth is obtained from the fermentation of the sugar. In the latter mode of growth, which is unaccompanied by alcoholic fermentation, free oxygen is essential, carbon dioxide in large amount retards growth, and the energy necessary for growth is obtained through some oxidation reaction carried out by the yeast.

As Slator observes, there is some similarity between the views now advanced by himself and those expressed by Pasteur with regard to the influence of oxygen on yeast growth. Thus, Pasteur observed *Études sur la Bière*) that yeast can live and multiply in absence of oxygen, although under these conditions the amount of yeast produced is very small by comparison with the amount of sugar fermented. Thus, in one experiment in which fermentation was effected with exclusion of air the ratio of the weight of (dried) yeast to that of sugar (sucrose) fermented was 1:89, whilst in another experiment in which a more mature yeast culture was used for seeding, the ratio was 1:176, and the yeast crop showed abundant evidence of involution. Pasteur inferred that in order to grow in absence of oxygen, the yeast cells must be young and vigorous and still under the influence of the vital activity produced by the free oxygen which has aided their formation, and which perhaps they have temporarily accumulated; very old yeast cultures were found to remain quite inert in a medium from which free oxygen was excluded. In further experiments, Pasteur showed that the ratio of yeast produced to sugar fermented or consumed is greatly increased by the presence of air, this ratio being as high as 1:4 under extremely favourable conditions of air access. Under such conditions a considerable part of the carbon dioxide evolved is produced, not by fermentation, but by oxidation resulting from assimilation of atmospheric oxygen, *i.e.*, to this extent the yeast behaves like an aerobic organism. Pasteur subsequently showed that with air access yeast can multiply in a solution of lactose in yeast-water without producing any fermentation whatever, thus proving that yeast is capable of a strictly aerobic existence. He concluded that the fermentative power of yeast can vary widely between limits which are determined by a maximum and a minimum access of oxygen. With maximum access of oxygen yeast ceases to be a ferment, *i.e.*, the ratio of the yeast crop to the weight of sugar consumed is of the same order as for aerobic organisms, such as moulds. This mode of life corresponds with the second mode of growth (growth in lactose-yeast-water in presence of oxygen) outlined by Slator. With minimum access of oxygen yeast still grows, though much less actively than in presence of more oxygen, and its capacity for fermenting sugar is greatest. This mode of life (*"la vie sans air"*) corresponds to some extent with the first mode of growth (initial stages of growth in malt wort) outlined by Slator, but Pasteur's view differs from that of Slator in that the former assigned an all-important rôle to the oxygen with which the yeast has previously been in contact. Slator considers that the increase in yeast crop obtained by aerating fermenting wort is due, not to the influence of oxygen, but to displacement of carbon dioxide, and he suggests that the larger yeast crop obtained from wort saturated with air compared with that from wort containing no air may be due to lessened supersaturation of the wort with carbon dioxide.

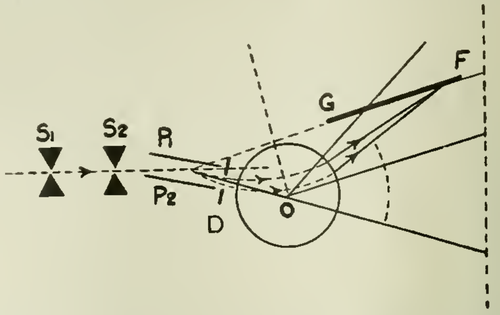
With regard to the two modes of growth, Slator states that "the factors determining which mode of growth takes place when both are possible have not yet been completely investigated." It is clear, from Pasteur's writings (*loc. cit.*, p. 252), that he considered that yeast can grow in both modes simultaneously, *i.e.*, as a fermenting organism and as an aerobe, and that the predominance of its fermentative or aerobic character depends on the amount of air at its disposal.

MASS SPECTRA AND ATOMIC WEIGHTS.

The atomic theory of matter put forward by Dalton in 1803 has remained one of the articles of faith of chemists until very recent years. Even now, only in one of the five main postulates of the theory has a flaw been detected. Dr. F. W. Aston, in a lecture delivered recently before the Chemical Society, reviewed the evidence, largely the outcome of his own work, which has undermined the chemist's and physicist's confidence in the postulate that "atoms of the same element are similar to one another and equal in weight."

The phenomena of radio-activity led to the conclusion that varieties of certain transformation products, more especially varieties of lead, were possible, which, while possessing chemical properties identical in every respect, nevertheless differed in atomic weight. This conclusion was abundantly verified by determinations of the atomic weight of specimens of lead derived from various sources, and the name "isotopes" was suggested by Soddy for such elements which, although exhibiting different atomic weights, yet occupy the same position in the Periodic Table. Moseley's work showed that the chemical properties of an element depend not on its atomic weight, but on its atomic number, which connotes the number of units of positive electricity on the atomic nucleus. Thus the atomic number of hydrogen is 1, of helium 2, of lithium 3, and so on. J. J. Thomson, by the method of positive-ray analysis, obtained evidence that neon, of which the accepted atomic weight was 20·20, was really a mixture of isotopes of atomic weights 20 and 22. The evidence was not as sufficiently conclusive as desired, and Aston undertook further investigations, using Thomson's method, but varying the procedure in order to obtain greater accuracy.

The apparatus employed is illustrated in the accompanying figure.* Positive rays proceeding from the perforated cathode of a cathode-discharge tube are sorted out into a thin strip by means of two parallel slits, S_1S_2, and are then spread into an electric spectrum by means of the charged plates, P_1P_2. A portion of this spectrum is isolated by the diaphragm D and passed between the circular poles of a powerful electromagnet O, whereby the rays are bent back through an angle more than twice the initial deflection. As a result, rays constituted of corpuscles having a constant mass converge to a focus, and a spectrum dependent upon mass alone may be photographed on a plate placed at GF.



The measurements of mass made in this way are relative to lines of known masses, thus C, 12; CH, 13; CH_2, 14; CH_3, 15; CH_4 or O, 16; CO_2, 44. When neon was employed in the tubes, spectrum lines corresponding to masses 10, 11, 20 and 22 were obtained. The first pair are what are termed second order lines, and arise from the presence of rays carrying a double charge. The relative intensities of the remaining lines indicated that neon was a mixture of an isotope of mass 20 with 10 per cent. of an isotope of mass 22, giving an average atomic weight of 20·20 in accordance with the accepted figure. The method has been applied to a number of electronegative elements, and lately it has been found possible to extend the method to the investigation of electropositive elements. The results obtained are summarised below:—

Table of Elements and Isotopes.

Element.	Atomic number.	Atomic weight.	Minimum number of isotopes.	Masses of isotopes in order of intensity.
H	1	1·008	1	1·008
He	2	3·99	1	4
B	5	10·9	2	11, 10
C	6	12·00	1	12
N	7	14·01	1	14
O	8	16·00	1	16
F	9	19·00	1	19
Ne	10	20·20	2	20, 22, (21)
Si	14	28·3	2	28, 29, (30)
P	15	31·04	1	31
S	16	32·06	1	32
Cl	17	35·46	2	35, 37, (39)
A	18	39·88	(2)	40, (36)
As	33	74·96	1	75
Br	35	79·92	2	79, 81
Kr	36	82·92	6	84, 86, 82, 83, 80, 78
I	53	126·92	1	127
X	54	130·2	5, (7)	129, 132, 131, 134, 136 (128, 130?)
Hg	80	200·6	(6)	(197-200), 202, 204
Li	3	6·94	—	6, 7
Na	11	23·00	1	23
K	19	39·10	2	39, 41
Rb	37	85·45	2	85, 87
Cs	55	132·81	1 (?)	133

The numbers in brackets are provisional. The results indicate that within an accuracy of 1 in 1000, *the weights of the atoms of all the elements measured, except that of hydrogen, are whole numbers*, thus re-establishing Prout's hypothesis, but with the modification that the primordial atoms are of two kinds, viz., the electron, or atom of negative electricity, and proton, the atom of positive electricity. A neutral atom of an element of atomic number N has a nucleus consisting of K+N protons and K electrons, and round this are set N electrons. An atom of atomic weight m is turned into one of atomic weight m+1 by the addition of a proton plus an electron. If both enter the nucleus, the atomic number is unaltered, and an isotope of the original atom results. If the proton alone enters the nucleus, an atom of the next higher atomic number results. If both new configurations are possible, elements of the same atomic weight but with different chemical properties result. Such elements are called "isobares." Their occurrence among radioactive elements is known. The hydrogen atom is unique; it is the only atom in which the nucleus is not composed of a number of protons packed very closely together. When four protons are packed closely with two electrons to form the helium nucleus, theory indicates a reduction of the effective mass, so that the helium nucleus will have a weight somewhat less than four times that of hydrogen. The lecturer concluded with the remark:—"Though as a chemist I view with some dismay the possibility of eighteen different mercuric chlorides, as a physicist, it is a great relief to find that Nature employs at least approximately standard bricks in her operations of element building."

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SOCIETY OF CHEMICAL INDUSTRY.

NEWS FROM THE SECTIONS.

SHAWINIGAN FALLS.

A dinner was held by the Shawinigan Falls Section at the Cascade Inn, Shawinigan Falls, on April 12, and was attended by about forty members.

After the customary toast to the King, the chairman, Dr. F. W. Skirrow, introduced Mr. V. C. Bartram, of the Canadian Electro-Products Co., who gave a very interesting address on the situation in Europe. Mr. Bartram passed a considerable portion of the year 1920 travelling in England, Holland, Belgium, France, Italy, and Switzerland, and he spent a month in Germany visiting most of the larger chemical centres. He was much impressed by the difference between the commercial conditions prevailing in Germany and those in England. There seemed to be absolutely no unemployment in Germany, and most industries were working at full capacity, especially those industries which were able to obtain their raw materials in the country. In many instances, however, plants were working at full capacity on raw materials obtained through outside interests, the owners of the materials being charged so much per kilogram or metre for the work done upon them. In this way employment was being maintained in Germany and unemployment in surrounding countries. Unless steps were taken to protect industries in Allied and neighbouring countries, it would, in Mr. Bartram's opinion, be very difficult for their manufacturers to compete with German manufacturers for some considerable period. Mr. Bartram found the German people very polite, and anxious to impress one with the extent of their wealth. It would appear as if the Germans, not knowing the exact steps which are going to be taken to collect the indemnity, are very keen to dispose of such wealth which they have retained in Germany to their own personal advantage, *i.e.*, to get the most enjoyment out of the money while they have it. Mr. Bartram is of the opinion that by proper control of industry and increased taxation, the Germans could well afford to pay the indemnity demanded by the Allies, and that at the present time they are really prosperous, although very short of some of the real necessities of life; however, they seemed to be reconciled to getting along with a minimum of luxury and without many of the things we here consider necessities.

Owing chiefly to the enormous inflation of money, a traveller in Germany gains the impression that the country is immensely rich, and that there are only two classes in Germany to-day, the extremely rich and the extremely poor. The inflation of money has been much greater than the increase in prices, and many persons who had property to dispose of have sold it and become very rich almost without effort. It would appear that Germany can only hold her present advantages in many of the world's markets she is now dominating until such time as the German populace tires of living under the conditions existing there to-day. There is no doubt that the Germans realise they have been beaten, but many feel that by sticking closely to work and doing everything possible to maintain production on an economic basis they are dealing a severe blow to Allied interests, and in this way getting back some of their own. It would hardly seem possible that the German populace can long continue to maintain their present standard of living, and doubtless the trade situation will rapidly be forced down to a level at which Germany will cease to enjoy her present advantages. The import duties adopted by other Governments to counteract the advantages Germany now enjoys through exchange should improve the situation in the rest of the world and particularly within the Empire.

Mr. Vinet, of the Shawinigan Water and Power Co., then made a few remarks on his visit to Germany with the Allied Army of Occupation in 1919.

MANCHESTER.

About 70 members attended the last meeting of the Session, which was held at the Textile Institute on May 6, Mr. John Allan presiding.

In a short communication on "Woad," Mr. J. Hübner stated that the prohibition of the import of dyes could be traced back at least to the 15th century, for he had found in the British Museum a special licence granted and signed by Henry VII. for the importation of 230 tons of woad from France. Although woad grew in this country from very early times, it was not cultivated here until the 15th century. When serious attempts were made to cultivate it, its importation was prohibited. Many of these attempts failed because continental growers, although willing to supply seeds, destroyed their germinating power by boiling them in water or smoking them in chimneys.

Mr. W. H. H. Norris read a paper on "Methods for the Complete Recovery of Nitre Cake," in which he described a process which had been used on a manufacturing scale. This consists, briefly, in digesting the cake with hot process liquor and so precipitating all the salt cake in a pure state, leaving the acid in solution. The mixture is filtered and washed in centrifugals, and the resulting acid liquor is used for ammonia absorption. The ammonium sulphate liquor is evaporated until a definite density is reached, and the process liquor is run back to the digester to neutralise the acidity of a fresh charge of nitre cake.

A new process for recovering sodium sulphate and a strongly acid liquor was also described, which involves running off the residue from the retort and pelleting it in a digester in presence of liquors of regulated composition. A second treatment of the liquor in the same vessel produces anhydrous sodium sulphate (96 per cent.). For transport, the acid liquor of 60 per cent. acidity may be diluted to about 25 per cent. acidity without risk of crystallisation taking place when cooled to 10° C.

Mr. R. Curtis, in a paper on "Works Accounts from the Chemist's Point of View," referred to the excellent work carried out during the war by the Department of Explosives Supply, and illustrated the type of system required by the works chemist with particulars of the method used at H.M. Factory, Avonmouth. The works chemist needs a detailed analysis of all manufacturing costs which must be made available at the earliest possible moment. Costing information supplied two or three months after the expenditure has been incurred is of little value.

ANNUAL MEETING, 1921.

CANADIAN ASBESTOS.

The asbestos-mining companies of Quebec have extended a cordial invitation to the members of the Society to visit their mines and mills on the occasion of the Annual Meeting in Montreal.

Although 85 per cent. of the world's asbestos is produced in Canada, it all comes from a comparatively small district about three hours' journey from Montreal. There are fourteen principal producers located at Coleraine, Black Lake, Thetford, East Broughton, and Danville.

The mining and milling of asbestos consists of quarrying proper, and the "cobbing" or separation of the fibre from the rock.

The first operation in opening a quarry is the removal of the surface soil, usually from 5 to 25 feet deep, for which steam shovels are employed. The exposed rock is drilled by hand, machine, or electric percussion-drills. This is followed by blasting with dynamite, every pound of which brings down about five tons of rock. Hand-cobbing separates the crude material into three grades:—(a) The long asbestos fibres and pieces of rock containing them; (b) the milling material or rock containing the shorter fibres; and (c) barren rock which goes direct to the dump.

The material specified in (a) is sent direct to the cobbing sheds, where the fibres are separated into different grades both by hand and machinery. The rock containing the shorter fibres is crushed and the asbestos separated from the waste by exhaust fans. The asbestos is now ready for the market, and is classed into two grades, termed respectively the "crude" and the "fibre." The crude is divided into two grades, No. 1 having fibres over 0·5 in. long, and No. 2 containing fibre under 0·5 in. These grades are used for asbestos cloth, pipe-covering, and other articles of which asbestos is the principal constituent. The material of shorter fibre is used in other manufactures, chiefly as a filler.

The production of asbestos has grown from 1400 tons, valued at £30,000, in 1885, to 120,000 tons, valued at £2,250,000, in 1919.

MEETINGS OF OTHER SOCIETIES.

THE INSTITUTE OF METALS.

On May 4 Prof. T. Turner, of Birmingham University, delivered the Eleventh May Lecture, on "The Casting of Metals." Sir George Goodwin, president of the Institute, was in the chair.

In opening, Prof. Turner referred to the castings of antiquity, mainly bronze, silver, and gold, many of which were of high quality and great beauty, but there was no reason to believe that the achievements of the past could not be equalled in design and excellence by modern methods, whilst output had been increased enormously and the percentage of wasters reduced. Casting may be defined simply as "the art of filling a given space by means of a molten metal or alloy"; yet it is the exception rather than the rule to obtain a perfect casting. In general, the higher the melting point of the metal or alloy the greater the casting difficulties, partly owing to the condition of the metal, and partly on account of the necessity for obtaining high-class refractories, sands, cores, fuels, etc. A valuable property of metals is their low viscosity in the liquid state; in most cases the viscosity does not exceed appreciably that of water, so that very intricate shapes can be cast. In addition, the surface tension as a rule is high, and coarse-grained-sand moulds can be used since they are not "wetted" by the molten metal or alloy. The latent heat of metals, which governs the rate of solidification, is usually the greater the higher the melting-point, but aluminium is a notable exception, having a very high latent heat The coefficient of expansion of aluminium is also very high and renders the metal liable to fracture while cooling in the mould. Molten metal, melted in ordinary furnaces, practically always contains in solution gases derived from the atmosphere of the furnace, and these gases may be evolved during solidification in the mould with the formation of blowholes. For most metals and alloys, however, there is a suitable pouring temperature at which the evolution of gas during casting is not excessive. The amount of "superheat" (heating above melting point) which is necessary to obtain sound castings varies greatly with different alloys.

Pure metals, as a general rule, possess the same density whether slowly or quickly cooled. In the case of alloys, especially those in which there is a wide temperature-interval between the liquidus and solidus, slowly cooled castings, such as sand-castings, frequently expand during solidification, and the result of this expansion is reflected in a reduction in the density of the alloy. The work of Prof. Turner and his students, in which the volume changes in a number of typical alloy systems during solidification were investigated, has shown the connexion between the constitution of the alloys and the alteration in volume, and the results can be correlated with the densities of the solid alloys. The lecturer closed with a reference to the causes of failure in casting metals, among which may be mentioned, pouring at an unsuitable temperature, imperfect cores, faults in moulding, cracks, misruns or run-outs, and breakage in handling. The losses from these and other causes are considerable; they usually amount to about 10 per cent. but sometimes to 40 per cent. of the output.

THE IRON AND STEEL INSTITUTE.

The annual meeting was held on May 5 and 6 at the Institution of Civil Engineers under the presidency of Dr. J. E. Stead. After the formal business was concluded, Mr. Harry Brearley read a paper on the welding of steel in relation to the occurrence of pipes, blow-holes, and segregates in ingots. His experiments were designed to ascertain to what extent the surfaces of cavities in ingots were welded up in operations such as forging, rolling, etc. He found that welding was as a rule not perfect, although it was frequently impossible to detect the weld in polished and etched samples. Under the notched-bar impact test, however, splitting frequently occurred along the welded surface when this was longitudinal in the test-piece. This tendency to splitting was greater the tougher the steel, and it was suggested that the quality of a weld could be measured by ascertaining the degree of toughness which must be induced in the steel in order to pull apart the welded surfaces in the ordinary Izod test. Mr. S. H. Fowles presented a paper on the cleaning of blast-furnace gas, and gave a description of the Halberg-Beth dry gas-cleaning plant. He pointed out that waste gas and heat should be used with the maximum efficiency, and that to use the gas under boilers was a barbarous practice. He advocated its use in internal-combustion engines, after careful purification in a suitable cleaning-plant; and he pointed out the defects of existing types of gas-cleaner, whether they were based on the wet process, the dry process, or the electrostatic process. Mr. J. E. Fletcher described graphic methods of representing the composition and melting points of various blast furnace and cupola slags, with a view to obtaining a clearer understanding of the theory of slags and of their practical utility.

The prevention of hardening cracks in a tungsten tool-steel containing 1·1 per cent. carbon and 0·8 per cent. tungsten was discussed by Mr. S. N. Brayshaw in a very long paper which embodied an enormous amount of experimental work. A series of milling cutters of complicated design was used for his experiments, which sought to correlate the liability to crack with the heat-treatment before and during hardening. A paper by Messrs. K. Honda, T. Matsushita, and S. Idei discussed the cause of quenching cracks. These are attributed to structural differences in the quenched samples; in small samples a core of martensite exerts a large tangential tension on the periphery, which consists largely of austenite; cracks in large samples may be formed as a result of stresses due to the structural differences between the inner and outer portions—pearlite and austenite—just below the A1 point. Mr. J. H. Whiteley described a preliminary investigation on the cupric etching effects produced by phosphorus and oxygen, respectively, in iron. From his results it appears that differences in the phosphorus content of less than 0·02 per cent. in adjacent parts of otherwise pure iron can be readily discovered by means of the cupric reagents; as the difference is increased, at least up to 0·15 per cent., the contrast becomes more and more pronounced. On the other hand, attempts have failed to produce an unequal distribution of oxygen which could be detected by cupric reagents in the same manner as that of phosphorus. Two methods of obtaining an unequal oxygen content were used:—(a) By soaking pure iron in its own oxide at a high temperature and then welding it with the unoxidised material; (b) by reducing highly oxidised iron in hydrogen and then welding it with the original metal at a low temperature. On etching, white resist-lines were formed at the weld junctions when oxygen was present, but these resist-lines were not formed when unoxidised iron was welded in dry hydrogen. Dr. Stead also contributed a paper dealing with the question of the solid solution of oxygen in iron, and from his results it appears that the absorption of oxygen into solid solution by iron can no longer be doubted. When iron, which has been heated in air or oxidising gases and has absorbed oxygen, is supersaturated, the oxide falls out of solution in the form of globules of free oxide. These globules become larger and larger as oxidation proceeds, eventually joining together to form continuous layers. Other globules which appear in iron as the result of gaseous action are sulphide of manganese and possibly protoxide of manganese, though in what form the sulphur enters the iron is not known.

Dr. A. Westgren's paper on "Röntgen Spectrographic Investigations of Iron and Steel" was introduced by Sir William Bragg. The paper is a brief report on the first results obtained by the application of Röntgen spectrographic methods to metallographic problems. The work described verifies Hull's result that iron at ordinary temperatures (α iron) has a cube-centred cubic lattice structure. The same orientation is found at 800° to 830° C., that is, within the so-called β iron interval, from which Dr. Westgren concludes that iron does not undergo any allotropic transformation at 768° C. The crystal lattice of austenite and of pure iron at 1000° C. is different from that of iron at the ordinary temperature. In martensite the iron atoms are grouped in exactly the same way as in α iron.

Further papers, which were not discussed, included "The Protection of Iron with Paint," by J. N. Friend, "Slip-Lines and Twinning in Electrodeposited Iron," by W. E. Hughes, "The Scientific Control of Combustion," by H. T. Ringrose, and "Comparison of Different Methods of Estimating Sulphur in Steel," by T. E. Rooney.

ROYAL PHOTOGRAPHIC SOCIETY.

At the meeting held on April 26 Mr. Chapman Jones gave a memorial lecture on Sir W. de W. Abney, one of the best-known workers in scientific photography, president of the Society in 1892—1894, 1896, and 1903—1905, and for many years the Honorary Editor of the Society's Journal. Mr. Jones prefaced his lecture with a short account of Abney's work and interests other than photographic. He was artist, archeologist, and astronomer, and, more particularly, an organiser and missionary in the application of scientific method to teaching. He was for many years associated with the Science and Art Department, and had considerable success in urging the necessity for adding practical work to class teaching. His researches in photography and allied subjects covered a very wide field. He was the first to apply spectroscopy to photographic research, and closely associated with this was his work on colour vision, colour measurement, and the principles of three-colour photography. He studied also the continuating action of light on bichromated gelatin, various problems concerned with photographic development, the efficiency and speed of shutters, and sensitometry. His work on emulsions included the production of plates specially sensitive to the infra-red, a problem which he studied both from the standpoint of the addition of materials to "weight the silver bromide molecule" and from that of the formation of a blue emulsion with strong absorption in the far-red. Both in this and in other work he several times anticipated modern research, having noticed, for instance, red-sensitising by treatment of plates with sodium sulphite, and having made use of wedge screens, both of silver and of platinum burned into the glass, in density measurements. Abney's activities were so numerous that the lecturer had time for very little more than to indicate their scope, the work on red-sensitive emulsions being treated in more detail; the printed lecture will include a bibliography.

ROYAL SOCIETY OF ARTS.

In a paper on "Paper Pulp Supplies from India" read before the Indian Section on May 3, Mr. W. Raitt discussed the possibilities of bamboo as the paper-making material of the future, having regard to the fact that the available supplies of timber for wood-pulp manufacture are rapidly becoming exhausted.

The present world consumption of paper may be put at 12 million tons per annum, 80 per cent. of which is made from wood pulp. It is estimated that India can produce annually 10 million tons of bamboo pulp and 3 million tons of pulp from Savannah grasses, and could therefore supply the whole world. Care and experience are necessary to avoid too frequent cropping of the bamboo, whereby its reproductive powers are impaired, but making allowances for these enforced rest periods, a 20,000-acre reserve should keep a factory with an output of 10,000 tons per annum running indefinitely.

Hitherto the chief difficulty in dealing with bamboo has been the high bleach-consumption of the boiled pulp. This may be avoided by modifying the conditions of boiling so that the starchy bodies and pectoses, which are mainly responsible for staining the pulp, are removed before the protective coating of lignin is removed from cellulose. This may be effected by subjecting the bamboo to a preliminary digestion with 1 or 2 per cent. soda at a temperature not exceeding 120° C. This treatment removes both starch products and pectoses without attacking the lignin. Further digestion with 4 per cent. soda at temperatures above 130° C. removes the lignin, leaving a pulp which bleaches comparatively easily. By this method of fractional digestion, the soda figure is reduced from 26 to 19 per cent., and the consumption of bleach of the boiled pulp drops from 16 to 11 per cent. The sulphate process of boiling can be modified in a similar way, but offers no advantages over the soda process. The treatment of the bamboo before boiling may consist in chipping or crushing. The latter method, though producing a more bulky charge, makes for better penetration and therefore better digestion.

It is estimated that bamboo could be transported to manufacturing sites in Burma at a cost of 12s. 6d. to 15s. per ton, equivalent to £1 11s. 3d. to £1 17s. 6d. per ton of unbleached pulp; the cost of manufacture would be under £10 per ton of pulp, so that taking £4 per ton as the future normal freightage, unbleached bamboo pulp could be delivered in this country for £16—£18 per ton, a figure which should compare very favourably with that of mechanical wood pulp. These figures are based upon estimated future costs of production when the present inflation of prices has passed.

THE FARADAY SOCIETY.

A meeting of the Faraday Society was held on May 9, Prof. A. W. Porter presiding. Mr. U. R. Evans introduced a paper by Dr. E. K. Rideal and himself on the Problem of the Fuel Cell, which dealt with attempts by the authors and others to obtain electrical energy by utilising carbon, directly as coal, charcoal, etc., or indirectly in the form of its combustion or reaction products, as one of the elements of a primary cell.

Fuel cells may be classified under three headings:—(1) Direct fuel cells burning solid fuel, which suffer from current polarisation due to the low velocity with which carbon enters into electrodic reactions. (2) Semi-direct fuel cells using gaseous substances derived from coal, etc., which are used to saturate the negative electrode; these also suffer from current polarisation owing to the difficulty of keeping the electrode material saturated with gas. This was overcome by Mond and Langer, but only by the loss of considerable quantities of platinum from the cell. (3) Indirect cells; these include (a) oxidation-reduction cells, in which the oxidising and reducing agents present in solution in the two compartments are re-generated by fuels and air respectively; the regeneration may take place in the compartment or externally; these suffer from both current polarisation, depending on electrode area, and time polarisation, dependent on the volume of the cell; (b) metal-anode cells, in which a metal obtained by reduction with fuel is used in the solid or the liquid state as the attackable electrode. A metal of low melting-point is desirable.

The authors' experiments on semi-direct fuel-cells, using nickel as the substratum of a gas-electrode, were unsuccessful. More promising results were obtained with the metal-anode type; zinc appeared unsuitable and difficulties were encountered with lead, but better results were obtained with cells (both hot and cold) in which tin formed the active element. The authors' results are, however, admittedly mainly of a negative character.

A paper by Dr. A. Ferguson described a "New Method for determining Surface Tension." Instead of measuring the height to which a column of liquid rises in a capillary tube, external pressure is applied to force the level of the liquid to the bottom of the tube, this pressure being measured by a delicate manometer. Among the advantages claimed for this method are that it avoids difficulties due to variations in tube diameter and to variations in temperature in the capillary tube itself; also the capillary tube may be very short, which facilitates cleaning. The method is rapid in use, and it gives results which are in good agreement with those obtained by the best methods previously known.

A paper by Mr. L. F. Knapp on "The Solubility of Small Particles and the Stability of Colloids" was taken as read.

THE METASTABILITY OF MATTER.

Lectures on "The Metastability of Matter and its Bearings on Chemistry and Physics" were delivered on May 10 and 12 at University College, London, by Prof. Ernst Cohen, of Utrecht University, a distinguished worker in the field of allotropy and polymorphism.

The first lecture was devoted to a general description of metastability as exhibited by elements. Enantiotropy was illustrated by reference to the grey and white forms of tin, and a striking experiment was performed showing that a contraction in volume of 30 per cent. occurs when grey tin is converted into white tin, an electrolyte being added to accelerate the conversion. The explosive form of antimony was taken as an example of monotropic allotropy, *i.e.*, of the existence of one form of an element which is unstable at all temperatures and pressures. Specimens of this form of antimony had been brought from Holland, and those which had survived the journey were shown to emit great heat when they were reconverted into ordinary antimony by scratching, 20 cal. from each gram of metal being evolved. The allotropy of non-metallic elements was discussed by reference to sulphur.

In the second lecture, Prof. Cohen reviewed the phenomena of metastability as exhibited by compounds. Polymorphism among compounds is often shown by differences in colour. Thus thallous picrate occurs in red and yellow varieties, the transition point being 36° C., but the yellow variety is obtained in a metastable form if cooled from above 36° C., and the red variety, if dry, can be heated up to 100° C. without changing into the yellow. Similar phenomena are shown by the black and red forms of mercuric sulphide. In all such cases, the conversion of the metastable form into the stable form at ordinary temperatures takes place slowly, but is accelerated by the presence of a very small amount of an electrolyte. Cadmium iodide was taken as an example of a salt existing in two forms possessing the same colour—the α or stable form of sp. gr. 5·8 and the β or metastable form of sp. gr. 4·8. The difficulty of crystallising cadmium iodide from solutions was shown to be due to the presence of a minute quantity of cadmium hydroxide. Ordinary cadmium iodide is a mixture of the α and β varieties. On dissolving the salt in water, the β form is converted to the stable α form, but the crystals separated from the solution consist of a mixture of both. The β form can be converted completely to the α form by heating to 150° C., but it has hitherto not been possible to obtain the β form pure; a mixture containing about 50 per cent. of the β variety is obtained by distilling the mixed compounds and cooling the sublimate in a stream of carbon dioxide. As further examples of metastability, reference was made to quartz, which exists in seven forms, to water, which exists in five modifications, and to calcium carbonate (calcite and arragonite). Lead nitrate exists in two modifications which exhibit a difference of about 2½ per cent. in their respective heats of solution in water. Among other substances which have been definitely ascertained to exist in more than one form are antimony iodide, potassium sulphate, barium sulphate, zinc sulphide, ammonium chloride, silver iodide, caustic soda, sodium tungstate, carbon tetrachloride, phenol, and urea. The existence of such modifications calls for a re-determination of the physical "constants" of very many substances.

NEWS AND NOTES.

FRANCE.

Industrial Notes.—*Chemicals and Fertilisers.*—Prices of heavy chemicals are falling gradually, especially those which a short time ago were greatly inflated owing to deficient supplies. Thus sodium sulphide, which a few months ago fetched 200 francs per 100 kg. is now selling at 65—70 fr. Recently published statistics of consumption of fertilisers show that the present supply exceeds the demand. There are large stocks of superphosphate; during the first few months of this year imports of rock phosphate from North Africa were only 165,000 t., as against 220,000 t. expected, and the price has been lowered to facilitate sales. On account of the small demand, basic slag has been re-inserted on the export free list. Ammonium nitrate is in poor demand, and owing to the arrival of 2400 t. of ammonium sulphate from Germany its price has been reduced to 30 fr. per 100 kg. But very little sodium nitrate is being purchased, the low value of the franc preventing purchases on the London market. The production of crude Alsatian potash in 1920 was 1,061,197 t., of which 450,000 t. was consumed in the country, 327,000 t. exported to America, 117,000 t. to Belgium, and 92,000 t. to England.

Metallurgy.—Little change is perceptible in the metallurgical market, but the acceptance of the Allied terms by Germany has induced a feeling of confidence which is benefiting the country economically and tending to make prices more stable. The high railway rates charged for metallurgical products are causing some anxiety, and there is a movement directed towards obtaining such modifications as will enable costs to be reduced. It is freely rumoured that an agreement will shortly be made between France and Italy by which:—(1) Italy will receive 100,000 metric tons of coal per month from the Saar coalfield. (2) French works will supply Italy with 35,000 t. of pig iron and 50,000 t. of semi-finished and finished products. (3) France will take from Italy 150,000 t. of iron scrap yearly, and more if Italy will purchase more pig iron from France.

Coal.—Owing to the coal strike in Great Britain, stocks of coal have considerably diminished during the past three weeks, particularly in the northern coalfields; they now aggregate some 600,000 t., which is still twice the amount usually held at this time of the year. Fuel consumption, however, will increase, especially when the anticipated revival in the metallurgical and glass industries takes place.

Petroleum.—Negotiations between France and Poland relating to the working of the Polish petroleum fields are reported to be progressing favourably. The agreement, it is stated, provides that in the event of war Poland would refuse to supply France's enemies with liquid fuel. At present French interests hold 60 per cent. of the total capital invested in the Polish oil industry and 80 per cent. of that invested in the refining industry. Many foreign undertakings are attempting to secure an interest in the industry, but Poland will only favour those that are backed by the French Government.

The Nitrogen Industry.—A Bill will shortly be presented to the French Chamber for sanctioning an agreement between the Ministry of War and the Société des Produits Azotés, by which the latter will take over the electrochemical works at Lannemezan and the hydro-electric works at Bordères-Louron and Lendenvielle for a period of 70 years. The company undertakes to increase the capacity of the plant to 20,000 tons of cyanamide and a similar quantity of carbide per annum, and the State will share the profits and receive certain dues.—(*Chem. Ind., Apr.* 25, 1921.)

UNITED STATES.

Nitrogen Fixation Plants.—The Secretary of War has ruled that pending the further development of the nitrogen-fixation industry by private interests, the Government plants at Sheffield, Ala., and at Muscle Shoals are to be retained under Army control in the most economical stand-by condition; and the Fixed Nitrogen Research Laboratory at American University, Washington, D.C., is also to be retained and continued under the War Department.

The Government Kelp Plant.—The United States Government kelp-plant is to be sold as soon as possible after July 1. The plant has been operated to determine whether carbon black, iodine, and potash salts can be recovered on a commercial basis, and it has treated 100 tons of wet kelp per day from which, it is claimed, 1500 lb. of carbon and two tons of potash salts are obtainable. The Bureau of Soils is more interested in finding a customer who will continue the experiments than one willing to pay a high price. The plant is being sold in accordance with the recent Agricultural Appropriation Bill.

Spring Meeting of the American Chemical Society.—The meeting held at Rochester under the presidency of Prof. Edgar F. Smith during the last week in April was one of the largest of its kind; more than 1300 attended and 282 papers were presented in eleven divisions and sections. The congestion of papers has led some of the divisions and sections to appoint committees to examine and revise papers beforehand and to decide whether they shall be read in abstract or *in extenso*, or not at all.

Dr. E. K. Mees gave an address on "The Measurement of Colour," Prof. Wilder D. Bancroft on "Blue Eyes and Blue Feathers," Dr. R. E. Wilson one on "Surface Films as Plastic Solids," and Prof. Irving Muir discoursed on "The Relation between the Stability and the Structure of Molecules." The new Petroleum Section made an auspicious beginning under the chairmanship of Dr. T. G. Delbridge, of Philadelphia; among a large number of papers presented to it was one by Dr. C. F. Maberg on the separation of non-volatile hydrocarbons by fractional solubility in hot ether-alcohol mixtures.

The Division of Industrial and Engineering Chemistry held a symposium of "Drying," a paper by W. K. Lewis on "The Rate of Drying Solid Materials" being one of the more interesting. A symposium which attracted much attention was that on "Our Future Supplies of Liquid Fuel." Prof. H. N. Whitford, of the Yale University School of Forestry, urged the conversion into alcohol of vast quantities of such tropical vegetation as cassava, nipa palm, or bamboo, and two other speakers advocated utilising the enormous quantities of waste wood in the U.S. forests. Better methods of agriculture and of conserving food products were proposed in the Division of Agricultural and Food Chemistry. One speaker described new groundnut by-products; four chemists suggested improved methods for the making of ice cream; another gave hints on preventing the discoloration of canned sweet potatoes; and a most helpful paper related to improvements in the manufacture of cheese. There was also an elaborate report on means of preventing the mosaic disease of spinach.

Advanced methods of manufacture considered by the Section of Sugar Chemistry and Technology should have an important influence on the production of sugar and may tend to stabilise prices. There seemed, however, to be no indication of a drop in the cost of the so-called "rare sugars," such as mannose, which is made from the shavings of the Ecuador ivory nut discarded from the button factories, and is now $142 per lb. These sugars are used for the detection of disease germs.

In the Dye Division a new process for producing alizarin from benzene as initial material was outlined by C. W. Schaffer, and a new method of making Malachite Green was also reported. A method for detecting and estimating carbon monoxide, based on the colour-change of a mixture of fuming sulphuric acid and iodine pentoxide, was described by C. R. Hoover; and the Division of the Chemistry of Medicinal Products discussed new non-habit-forming drugs to take the place of those narcotics which enslave. An interesting feature of the meeting was the visit to Kodak Park, the largest of the works of the Eastman Kodak Co. at Rochester, which produces about 125,000 miles of kinematograph films, uses over 1300 tons of cotton and over 150 tons of pure silver yearly.

The membership number of the Society at the end of 1920 was 15,582.

Phosphate Rock in 1919.—The phosphate rock marketed in the United States in 1919 amounted to 2,271,983 long tons, valued at $11,591,268, which showed a decrease in quantity of 9 per cent. and an increase in value of 41 per cent. over the figures for 1918. The actual quantity mined was 1,851,549 tons, or nearly 19 per cent. less than in 1918. There was an increase in the output from South Carolina, Tennessee and the Western States, but production in Florida, the chief producing State, fell by 20 per cent. owing to a prolonged strike. Exports fell during the war to only about one-tenth of their pre-war volume, having declined from 1,300,000 long tons in 1913 to about 143,000 t. in 1918, but in 1919 they improved to over 378,731 t. In 1920 the total quantity marketed was 4,103,982 long tons (Florida 82%, Tennessee 16%), and the exports rose to 1,070,012 t. The market for American phosphate in Southern European States is bound to be small because France and Spain have ample supplies available from Tunis and Algeria, and have greatly increased their capacity to manufacture sulphuric acid.

World's production of phosphate rock in 1918–19.

	1918.	1919.
	Metric tons.	
Algeria	198,539*	276,040
Angaur Island	—	—
Belgium	61,700	—
Canada	127	22
Christmas Island	—	—
Dutch West Indies :—		
Aruba	—	—
Curacao	—	10,058
Egypt	31,147	29,364
France	—	—
French Guiana	—	—
Japan, including Rasa Island	191,722	—
Makatea Island	—	40,000
New Caledonia, Huon Island	—	—
New South Wales	305	585
New Zealand	5,080	—
Norway	—	—
Ocean and Nauru Islands	—	—
South Australia	8,204	6,045
Spain	43,303	25,035
Tunis	821,145	—
United States	2,530,612	2,308,448

* Exported.

(For the world's production in 1913, 1915, and 1916, *cf.* J., 1920, 168 R.)—*U.S. Geol. Surv., Feb., Mar.*, 1921.)

Strontium in 1919.—Strontium ore was first mined in the United States in 1916, when, under the stimulus of high prices and war needs, 250 short tons was produced and marketed. In 1917, 4305 t. was marketed, in 1918, 400 t., and in 1919 there was no production at all. During 1919, 1393 t. of crude celestine was imported from England, and also certain manufactured salts. The production of salts, chiefly the nitrate, was 1,387,555 lb.; the carbonate was also made, mostly for use in the manufacture of other salts, but some was used for experimental work in sugar-refining. Should these experiments lead to the general adoption of strontium compounds for the refining of beet sugar in the United States and Canada, the mining of strontium ore would be revived on a large scale. As is well known, strontium salts are used chiefly in the manufacture of fireworks, signal lights, and medicines. A little strontium is alloyed with copper in making castings, to harden the copper and to prevent the formation of blow-holes. For this purpose the alloy is obtained either by adding to the melt a little metallic strontium, or by electrolysing fused strontium chloride, using a copper cathode. The small amount of strontium introduced into the copper does not affect its electric conductivity.—(*U.S. Geol. Surv., Dec.* 5, 1920.)

AUSTRALIA.

A Proposed New Industry for Victoria.—At Bendigo, in Victoria, works are proposed for the manufacture of paints and glazing preparations for pottery-ware. Pottery is already produced in the neighbourhood. Large deposits of red ochre and hæmatite in the district are to be developed, and these will provide the raw material. A site for the works has been secured close to the Bendigo-Echuca railway line.—(*Hardware and Machinery, Feb.* 4, 1921.)

The Sugar Situation.—It is announced that the Commonwealth Government will continue to pay Australian sugar growers £30 6s. 8d. a ton for raw sugar during the current year, wholesale and retail prices being fixed at £49 per ton (refined) and 6d. per lb., respectively. The crop for 1920–21 is expected to be heavy and will, it is hoped, suffice for requirements, in which case the price may be reduced. Up to June 30, 1920, the Commonwealth Government had lost over £900,000 on its sugar transactions, but these losses will probably be recovered by August 1, 1921. Imports of sugar during the last two years were:—1918–19, 52,569 t. (£1,052,124); 1919–20, 112,805 t. (£4,359,203); Dec. 31, 1920, 24,475 t. (£1,059,342).—(*Bd. of Trade J., May* 19, 1921.)

BRITISH INDIA.

Indian Bauxite.—In the first number of the *Journal of Industries and Labour* Dr. J. Coggin Brown, of the Geological Survey of India, contributes an article on bauxite with special reference to its occurrence and exploitation in India. The richest areas yet discovered are on the Baihir plateau, in the Balaghat district, and near Katni, in the Jubbulpore district, both in the Central Provinces. Valuable ores are also found in the Mandla and Seoni districts of the Central Provinces and in the States of Sarguja and Jashpur. The Balaghat bauxite, like that of Jubbulpore, is of very high grade, and there seems little doubt that large quantities are available; eight analyses of samples gave: Al_2O_3, 51·62—58·83%; Fe_2O_3, 2·70—10·58%; TiO_2, 6·22—13·76%; and combined water, 22·76—30·72%. Occurrences of limited extent but of excellent quality exist in Western Chota Nagpur, and considerable amounts of the mineral are associated with the iron ores of the Bababudan Hills. A series of analyses of samples from the Kemmangundi area gave: Al_2O_3, 34·20—62·50%; Fe_2O_3, 5·10—40·70%; SiO_2, 0·26—13·60%; and water, 20·00—31·90%. Further deposits have been found in the Bhopal, Rewah, and Tonk States of Central India, the Satara district of Bombay, the Madras Presidency, and elsewhere. The official figures of the output of Indian bauxite, *e.g.*, 1192 tons in 1918, in no way reflect the potentialities of the deposits, which are now being investigated by the Geological Survey with a view to publishing a memoir on the subject.

In 1907 Sir Thomas Holland stated that probably the best means of effecting the large-scale development of Indian bauxite was to manufacture pure alumina locally by extraction with alkali for export to aluminium works or for the local manufacture of aluminium salts. Exportation of the raw or calcined material was not practicable, and the installation of aluminium works in India would involve heavy capital outlay under untried conditions and elaborate investigation before power works could be erected. Since then, however, several concessions have been taken out and more extensive knowledge of suitable sites for power stations has been acquired; but in the event of the erection of an aluminium works in India, a part of the production would have to be exported, as the Indian consumption is comparatively small. The success of aluminium enterprises in other countries has depended more on cheap electrical energy and large-scale production than on other factors.

The article also contains useful information on grades and specifications, markets, prices, and chief sources of supply.

JAPAN.

Petroleum Production.—The Department of Agriculture and Commerce, Tokyo, has issued the following statistics of production of crude petroleum and its distillation products during the period 1917–20. In the appended table the quantities are given in barrels of 35 Imperial gallons, and natural gas is included under "crude oil":—

	1917.	1918.	1919.	1920
		Thousands of barrels.		
Total crude oil	2949·4	2535·4	2350·5	2364·1
Naphtha	141·8	166·8	167·9	165·6
Lighting oil	517·3	349·4	276·8	209·9
Light oil	697·7	744·2	657·9	697·7
Lubricating oil	400·4	393·6	415·2	442·4
Heavy oil	622·8	376·6	224·6	209·9

—(*Ch. of Comm. J., May* 6, 1921.)

GENERAL.

Lead Poisoning.—Referring to Dr. Miall's remarks on lead poisoning in a recent issue of this Journal (p. 140 R), Miss Helen Masters, of King's College for Women, University of London, writes that safeguarding the health of the workers is not the only aspect of the problem, and that the possibility of the public suffering from the use of lead glazes on cooking utensils must also be taken into consideration. Miss Masters published in the *Analyst* (1919) and in the *Lancet* (1920) the results of her examination of glazed earthenware casseroles of English, French, and Dutch manufacture, which showed that practically all of them yielded soluble lead compounds on boiling with dilute solutions of organic acids such as might be present in ordinary cooking processes, and she adduced other evidence of the danger of using such lead-glazed ware. In the interests of public health she now advocates either that the use of lead glaze for cooking utensils should be prohibited, or that a standard test be adopted to which such vessels should be submitted before being placed on the market.

Tetrachlorethane Poisoning.—Tetrachlorethane, the non-inflammable solvent which came into prominence during the war as a constituent of aeroplane "dopes," is now used industrially as a solvent for cellulose esters, etc., in the manufacture of such articles as non-inflammable films, lacquered goods, and artificial silk. In a paper in the April issue of the *Journal of Industrial Hygiene* Dr. D. C. Parmenter, of Harvard University, describes the symptoms of tetrachlorethane poisoning and discusses methods of prevention. His observations were made in an artificial-silk factory and extended over five months, during which period twenty-one cases of poisoning occurred, but no fatalities. The initial symptoms are abnormal fatigue, discontent, general nervousness, and loss of appetite, and as the poisoning progresses these are accompanied by nausea and vomiting. Such symptoms, although often not marked, are nevertheless detectable by careful observation, and their proper interpretation, together with a clear understanding of the importance of the blood findings, makes possible the prevention of all but the very slight cases of poisoning. Ventilation is an important preventive, and the wearing of gas-masks is recommended in special cases, *e.g.*, in dissolving cellulose acetate and in working with acetic anhydride. Dr. Parmenter concludes that the industrial use of tetrachlorethane presents no more difficulties than that of benzol, TNT, or lead.

Chemical Industry in Germany.—In consequence of the "Sanctions," the demand for chemical wares has greatly diminished, and export business has practically been at a standstill since the beginning of April. It is anticipated that the exports for the first half of this year will show a very considerable falling off from those of the corresponding period of 1920, when 1,482,421 metric tons of chemicals, drugs, dyes, etc., valued at 4560 million mk., was exported (the corresponding figure for 1914 was 2,415,550 t.). The exports for Jan.-June, 1920, included:—Potash salts, 527,960 t. (807 million mk.); coal-tar dyes, 8850 t (849 mill. mk.); indigo and indigo-carmine, 4506 (257 mill. mk.); alizarin and alizarin dyes, 2004 t. (134 mill. mk.). Although the nitrogen factories have been fully employed, production has seriously declined in practically all other branches of the chemical industry.

Exportation of chemicals continues under the control of the "Aussenhandelstelle Chemie" (Export Bureau) in Berlin, which was established in June, 1919, as an autonomous organisation for the chemical industry to be conducted on strictly business lines. It is subdivided into sections corresponding to the chief divisions of chemical industry; it issues licences for importing and exporting chemical products, and fixes minimum prices for exported goods. The fees charged by the Bureau for its services are 1 mark per 1000 marks of the value for export, and 30 pfg. per 1000 marks of the import value.

A small book entitled "Chemicalia" has just been published in Berlin that is designed to take the place of the well-known reference-book "Wenzel," which has not been on sale for about ten years. The new book gives the names, addresses, etc., of all the important chemical manufacturing firms, together with a list of their specialities in the German, English, French, and Spanish languages, and it contains much other information of value to producers, consumers, and traders.

The Chemical Industries of Upper Silesia.—Both before and during the war the chemical industries of Poland were very undeveloped, and the country's requirements in fertilisers, dyes, drugs, and substitutes for textile finishing, etc. were derived in a large measure from Upper Silesia, where chemical industries were first established in the period 1867—1880. At that time there were only about ten manufacturing firms of any consequence, and at the present time only one of these employs more than 100 full-time workers. Between 1890 and 1900 development proceeded apace, and the two largest undertakings established during this period—the Rütgers-Werke and the A.-G. Lignose Konzerns—still play an important part in the chemical industry of Upper Silesia; the former produces manufactured fuel, electrodes, etc., employs 1300 workers, and has a capital of 40—50 million marks, and the latter manufactures ammonium nitrate, nitric acid, explosives, etc., and employs over 1000 workers. The period 1900—1910 saw the establishment, in Gleiwitz, of a branch of the Griesheim Elektron company, which produces mainly oxygen, the Oberschlesische Farbwerk, Idaweiche (lithopone), the Oberschlesische Thomas-Phosphatwerke, Sczepanowitz near Oppeln (fertilisers), the Mineralölraffinerie Idaweiche (mineral-oil lubricants, etc.), the Oberschlesische Isoliermittel, G. C. Flegel and Co., Kattowitz, the Chemische Werke Carbon at Ratibor, and others. During the war period and after, the following new undertakings have been established:—The A.-G. Lignose, Kriewald, and the Chemische Fabrik von Heyden, Kostucha, both of which make potassium chlorate; the Oberschlesische Zellstoffwerke, Krappitz (cellulose, etc.), with a capital of 1·5 million mk.; the Oberschlesische Phosphatwerke, Oppeln, founded in 1919 with a capital of 300,000 mk. A small water-glass factory was erected in Hindenburg in 1918, and in 1920 the Oberschlesische Stickstoffwerke was established to acquire, erect, and manage nitrogen factories with a (present) capital of 250,000 mk. The Oberschlesische Zinkhütten (zinc smelters) in Kattowitz, which dates from a much earlier period, produces sulphuric acid from the roasting of blende. It will thus be seen that the chemical industry of Upper Silesia is of considerable magnitude; it comprises 60—80 undertakings, employs about 5000 workers, and commands a total capital of 150—200 million mk., exclusive of the important coke-oven plants. The coking industry has steadily developed in recent years, and early in 1920 the individual firms formed a company—the Chemische Werke Oberschlesiens—for the purpose of jointly working up and selling their entire production of tar and ammonia. The Oberschlesische Kokswerke und Chemische Fabriken, which was founded in 1890 and is now working with a capital of 35 million mk., has plants at Stalley (195 ovens), Zabrze (75 ovens), Poremba (220 ovens), and Glückauf (60 ovens); the tar is worked up by the Oberschlesische Gesellschaft für Teerverwertung, the tar oils are sold by the Verkaufsvereinigung für Teererzeugung in Essen, the pitch is taken by the Upper Silesian briquette factories, and the ammonia is converted into sulphate and distributed through the Nitrogen Syndicate in Berlin.—(*Chem.-Z., Apr.* 26, 1921.)

Austrian Magnesite.—Owing to the extraordinary demand for this mineral, many developments are taking place; new and valuable deposits have been discovered and exploited, and production is to be carried on at maximum capacity. The mines are all situated in present-day Austria, and all the more important belong to the Veitscher Magnesitwerke A.-G., which operates the Veitsch and Trieben mines in Styria and the Breitenau mine in Lower Austria. The life of the Veitsch mines is estimated to be 200 years at the present rate of production. Last year a French-Swiss group, which included the Schneider-Creusot Co., acquired an interest in this undertaking; profits were 23 million kronen and a dividend of 40 per cent. was paid (4 mill. kr. and 10 per cent. in 1919). Among recent developments may be noted the formation of the Steirische Magnesitindustrie A.-G., with plants at Oberdorf and Neuberg, the discovery of promising deposits at Mayrhofen, acquired by the Veitsch company, and the working of valuable deposits near Kraubath; the Salzburger Magnesit Industrie Gesellschaft is planning the exploitation of mines in the Salzburg country, and a new company is operating the mines at St. Martin in Styria. During 1913, 123,900 t. of the calcined mineral was exported, and in 1920 about 63,000 t.—(*Times Tr. Supp., May* 14, 1921.)

German Beet-Sugar Production in 1920–21.—The German beet-sugar crop for 1920–21 is estimated to be about 1,200,000 tons, an amount which will enable household rations to be increased and permit of distribution to all industries. It is announced that the internal tax on sugar is to be increased to 100 mk. per 100 kg., and with the mark at its present value the result would be to favour export of sugar, as in comparison with the world value the tax is nominal on the prices made by exported sugar. Germany's consumption, however, is much higher than the production, and export is unlikely. —(*Ind. Tr. J., Apr.* 1, 1921.)

Production of Blackstrap Molasses in Cuba.—The estimated production of blackstrap molasses in Cuba in 1920 was 180 million gallons (U.S.A.), of which 20—30 million galls. was used locally in the production of fuel alcohol. The storage and conservation of the molasses by the sugar mills largely depends on the market price, and much of it is burned at the sugar factories as fuel. The demand is expected to increase, especially if alcohol comes into use as a motor fuel. Shipments of blackstrap molasses from Cuba amounted to 199,193,722 galls. in 1917, 163,716,219 galls. in 1918, and 49,782,231 galls. in the first six months of 1919.—(*U.S. Com. Rep., Mar.* 5, 1921.)

Sugar-Beet Cultivation in Shantung.—The announcement that a beet-sugar factory is to be established at Wangtaichiao, near Tsinanfu, by a Chinese company, the Pu Yih Industrial Co., marks the first attempt to establish a beet-sugar industry in Shantung. Machinery is being obtained from the United States and Japan, and sugar-beet seed is being distributed in the districts around Tsinanfu. Favourable conditions of soil, climate, and water supply appear to obtain in Shantung, and with abundant cheap labour, the success of the enterprise would seem to be assured. The company has secured a monopoly of the industry for 24 of the 100 or more districts in Shantung.—(*U.S. Com. Rep., Mar.* 5, 1921.)

The World's Petroleum Output in 1920.—The American Petroleum Institute estimates the world's production of petroleum in 1920 at 688,474,251 barrels, which represents an increase of 24·2 per cent. over the previous year. The estimated production in barrels by countries is as follows:—

	1919 Barrels.	1920 Barrels.
United States	377,719,000	443,402,000
Mexico	87,072,954	159,800,000
Russia	34,284,000	30,000,000
Dutch East India	15,780,000	16,000,000
India	8,453,000	8,500,000
Rumania	6,517,748	7,406,318
Persia	6,289,812	6,604,734
Galicia	6,255,000	6,000,000
Peru	2,561,000	2,790,000
Japan and Formosa	2,120,500	2,213,083
Trinidad	2,780,000	1,628,637
Argentina	1,504,300	1,366,926
Egypt	1,662,184	1,089,213
France (Alsace-Lorraine)	—	700,000
Venezuela	321,396	500,000
Canada	220,100	220,000
Germany	925,000	215,340
Italy	38,254	38,000
Total	554,505,048	688,474 251

In 1920 the United States produced 64·4 per cent. and Mexico 23·2 per cent. of the world's output.—(*Min. Mag., Apr.*, 1921.)

Wood-pulp Manufacture in Alaska.—The United States Department of Agriculture has recently received samples of the first run of a new pulp-mill established at Juneau, in the Tongass National Forest. The mill, the first to be established in the territory, is operated by hydro-electric power, and has a capacity of 20 tons a day, with power resources available for increasing the output to 250 tons. So far spruce has been utilised, but hemlock will be ground for newsprint purposes, and the eventual manufacture of paper at the mill is planned. An area of the Tongass National Forest containing 2000 million feet of pulp-wood will, it is stated, shortly be placed on the market in response to inquiries from prospective paper manufacturers.—(*Bd. of Trade J., Apr.* 14, 1921.)

Saccharin Monopoly in Yugoslavia.—The Government monopoly of saccharin and other sugar substitutes in Yugoslavia has hitherto been effective in Bosnia and Herzegovina only, but it is now to be applied to the whole State.—(*U.S. Com. Rep.*, *Apr.* 1, 1921.)

Peppermint Distillation in Piedmont.—The cultivation and distillation of peppermint in Piedmont is a small but very profitable industry, as the demand greatly exceeds the production. In 1920 the crop from 1483 acres was 22 million lb., which on distillation yielded 59,525 lb. of peppermint oil, valued at 6 million lire (£240,000 at par). It is anticipated that the crop for 1921 will be roughly 20 per cent. larger than that for 1920, as the distillers have promised higher prices to cultivators in order to increase production.—(*U.S. Com. Rep.*, *Apr.* 13, 1921.)

Fuel Oil from Sicilian Asphalt.—One of the richest areas of the asphalt deposits in Sicily is owned by an Italian company which, in addition to working up the material into products for paving and roofing, has developed a process for the production of mineral oil with a very low bituminous content and a calorific value of 10,300 calories per kg. A large battery of gas furnaces is employed, and the heat of the ash is almost completely recovered by means of a current of the inert gases from the condenser discharges; particles of oil carried over in the combustion fumes are recovered by means of centrifugal filters and condensers. The output for 1920 is estimated to be 5000 metric tons of oil, and is hoped to increase this to 10,000 t. in 1921. The company is planning the erection of a large refinery near Rome.—(*U.S. Com. Rep.*, *Feb.* 11, 1921.)

Sumac Production in Sicily.—Sicily is the largest producer of sumac in the world, the United States taking second place. The annual output in recent years is estimated at 15,000 metric tons, which is 50 per cent. below the pre-war production. This decrease is due to diminished cultivation, which is believed to be only temporary. Male sumac is found in the provinces of Palermo and Girgenti, and contains 28 per cent. or more of tannin, whereas female sumac, found mainly in the provinces of Catania and Girgenti, contains an average of 24 per cent. There are about eight large sumac-grinding mills in Palermo, but no factories for preparing the extract, although it is considered probable that they will be built when the trade revives. Exportation from Palermo is chiefly directed to Great Britain, the United States, France, and Germany (*cf.* J., 1920, 263 R).—(*U.S. Com. Rep.*, *Mar.* 23, 1921.)

Columbian "Pita" Fibre.—The term "pita" is used very widely in Central and South America, and is applied to several fibre plants (including sisal hemp) and also to string. Colombian "pita" belongs to the *Bromeliaceæ* and is a species of *Ananas*, closely allied to the pineapple; it grows in the shade of forest trees, forming extensive, impenetrable areas known as "pitales," but it can be grown on light open land and at altitudes ranging from sea-level to 3000 ft. The fibre is said to be superior to sisal in strength, fineness, and durability, and if available commercially it would compete with sisal hemp in the manufacture of rope and twine. The average annual yield of the forest "pitales" is estimated to be 45·5 tons of leaves containing 5 per cent. of fibre. By the native method of extraction about 40 per cent. of the fibre is wasted, so that if 3 per cent. could be obtained by mechanical extraction, the yield would be about 1·5 tons of dry fibre per acre. Certain advantages are claimed from the harvesting of fibre from the natural "pitales" as compared with cultivation of sisal plantations, but the difficulty is that no machine is yet available for extracting the fibre from the leaves.—(*Imp. Inst. Bull.*, XVIII., No. 4.)

The Industrial Value of Perilla Seed.—In view of the increased demand for drying oils, it has been thought that the cultivation of Perilla seed (*Perilla ocymoides*) might be encouraged in British possessions; at present it is grown for commercial purposes principally in Manchuria, China, and Japan. To this end the Imperial Institute sent out samples of Japanese seed to India, East Africa, South Africa, Rhodesia, and Cyprus for trial cultivation, and a report from Cyprus is now published in the *Bulletin of the Imperial Institute*, Vol. XVIII, No. 4. The seeds contained 6·3 per cent. of moisture and yielded 43·1 per cent. of oil (46 per cent. on a dry basis) which possessed the properties of Perilla-seed oil, and which should be readily saleable in this country for paint and varnish making and other purposes for which a drying oil is required. The residual meal contained 35·6 per cent. of protein and 18·9 per cent. of fibre, and would probably be a valuable feeding stuff; trials, however, are required to determine this point. The authorities in Cyprus have been asked to continue the experiments.

Finsbury Technical College.—The threatened closure of this valuable institution having been averted (*cf.* J., 1921, 150 R), the Governing Body announces that the entrance xamination for the session 1921—22 will be held on September 20 next. Applications for admission should be forwarded to the College not later than September 15 on forms to be obtained from the Registrar, Leonard Street, City Road, E.C. The programme of the College is under revision and will be issued in due course.

PERSONALIA.

Mr. W. B. Worthington has been elected president of the Institution of Civil Engineers for the year 1921–22.

The list of newly elected foreign members of the Royal Society includes the names of Prof. Albin Haller and Prof. P. Zeeman.

Mr. C. R. Delong has succeeded Dr. Grinnell Jones as chief of the Chemical Division of the United States Tariff Commission.

Senator Piero Ginori Conti is succeeding Prof. G. Ciamician as president of the Associazione Italiana di Chimica Generale ed Applicata.

The Willard Gibbs Medal of the Chicago Section of the American Chemical Society is to be presented to Madame Curie at a special meeting to be held on June 14.

The University of Glasgow is to confer the honorary degree of LL.D. upon Sir Dugald Clerk and Prof. J. C. Irvine, principal of St. Andrew's University.

Prof. P. H. M.-P. Brinton, head of the chemical department in the University of Arizona, has been appointed professor of analytical chemistry in the University of Minnesota.

The Court of the University of Manchester has conferred the honorary degree of Doctor of Science upon Sir E. Rutherford, formerly professor of physics in the University.

Sir J. J. Thomson has been elected honorary professor of natural philosophy, and Sir Ernest Rutherford professor of natural philosophy, in the Royal Institution of Great Britain.

The death of Dr. E. B. Rosa, chief physicist to the Bureau of Standards, Washington, D.C., is announced by *The Times*.

PARLIAMENTARY NEWS.

HOUSE OF COMMONS.

Wage-Reduction in Industries.

In a long written reply to Sir W. de Frece Dr. Macnamara gave a list of the industries in which wages have been reduced in recent months. The list includes chemicals; soap and candles; bleaching, dyeing and finishing; iron-ore, shale, fireclay, and gypsum mining; limestone quarrying; iron and steel; coke and by-products; tinplate; glass-bottle manufacture.—(May 6.)

Arseno-Benzol Treatment of Venereal Disease.

Replying to Mr. R. Richardson, the Minister of Health (Sir A. Mond) stated that 22 deaths had been reported from the administration of arseno-benzol at centres for the treatment of venereal disease; in three of these cases death was not due to the drug, and in five others it was not certain how far the drug had contributed to the fatal result. In the last complete year for which statistics were available the administration of the drug might have been a contributory cause of, roughly, one death in every 4300 patients treated for syphilis, and of one death in every 30,000 injections. The suggestion that such information as the above should be included in a Departmental report would be considered.—(May 12.)

Home-Grown Sugar, Ltd.

Mr. Young, in answer to Lieut.-Col. Nall, said that it was proposed to make an advance, under certain conditions, to Home Grown Sugar, Ltd., on second mortgage of the sum of £125,000 recently voted for the purpose on the estimate of the Ministry of Agriculture. In addition, Parliament would be asked, if necessary, to provide in each of the ten years ending March 31, 1930, a sum that with the divisible profits of the company would enable 5 per cent. per annum to be paid on the £250,000 ordinary shares issued to the public, such advances to be repayable out of future profits. It was hoped that the arrangements would not prove to involve any subsidy, but in any case the agreements made between the Government and the company could not be reconsidered (*cf.* J., 1920, 223 R, 1921, 108 R).—(May 13.)

German Reparation (Recovery) Act.

Mr. Chamberlain, answering Capt. Wedgwood Benn, said that the Government would not repeal or suspend the above Act until it had had further experience of the working of the terms to which Germany had just subscribed, but the rate of duty would be reduced to 26 per cent., and its collection here would be in lieu of and not in addition to the general levy on all exports collected in Germany.—(May 13.)

Safeguarding of Industries.

The two financial Resolutions dealing with "key" industries, dumping, and depreciated exchange (*cf.* J., 1921, 131 R) were considered on May 9, 10, and 11, and passed without amendment. In introducing the first Resolution (relating to the 33⅓ per cent. *ad val.* duty on certain imported articles) the President of the Board of Trade based his argument largely on the needs of national defence, and stated (*inter alia*) that the prospects of the chemical industry were illimitable and its development absolutely necessary. Mr. Jameson (West Edinburgh) spoke of the grave danger to which the rubber-tyre industry was exposed owing to competition not only from the United States, but from France and Italy, and of the present widespread unemployment in that industry. Sir J. Norton-Griffiths urged the claims of the gas-mantle industry to be safeguarded, stating that at the present time the works at Wandsworth were virtually shut down. Mr. Hannon asked for protection for the manufacture of electrodes and vitrefied grinding wheels. Dr. Murray opposed the inclusion of optical glass on the ground that microscopes, etc. would become dearer to students of science. Mr. Kiley, in moving to omit beakers, flasks, etc., said that "lamp-blown ware" included common lamp-shades, and a beaker was practically "a glass jug without a handle"; he could not see how the latter could help to win a war. Mr. Lyle-Samuel, in alleging the inferiority of British chemical glassware, said that it appeared to "undergo some form of chemical dissociation" in use, and that it had a "shorter life when exposed to atmospheric conditions." All the proposed amendments were defeated by large majorities.

OFFICIAL TRADE INTELLIGENCE.

(*From the Board of Trade Journal for May* 12 *&* 19.)

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W. 1, from firms, agents or individuals who desire to represent U.K. manufacturers or exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department and quoting the specific reference number.

Locality of firm or agent.	Materials.	Reference number.
British Honduras	Matches, drugs, medicines, soap, rope	604
British West Indies	Matches, paint, paper, galvanised iron	624
Canada	Pottery, aluminium ware	600
New Zealand	Glassware	602
South Africa	Mining and farmers' supplies	623
Bulgaria	Sheet iron, galvanised iron, tinplate, blackplates	605
Denmark	Laboratory supplies	629
France	Writing and printing paper	608
,,	Pharmaceutical products, crude drugs, dyes	609
Belgium	Bar iron, crucible steels	610
Serb-Croat-Slovene State	Drugs	615A
Switzerland	Oilcake	632
United States	Chemicals, dyes	618
Argentina	Heavy and fine chemicals	619

Markets Sought.—A Canadian manufacturer of bleached sulphite wood pulp invites inquiries from U.K. paper makers. [Inquiries to the Canadian Government Trade Commissioner, 73, Basinghall Street, London, E.C. 2.]

A merchant in British Honduras wishes to get into touch with U.K. importers of logwood, fustic, chicle, and rubber. [604.]

TARIFF. CUSTOMS. EXCISE.

Brazil.—The sanitary stamp tax on pharmaceutical specialities has been revised.

British Guiana.—The forms of certificates of origin for goods imported under the British Preferential tariff are given in the issue for May 12.

Canada.—Hard soap (not being whale-oil or castile soap) is rated for duty under Tariff item No. 228 when the fair market value thereof at the place of manufacture abroad is over 9 cents per lb. wholesale.

Denmark.—All goods arriving at the free port of Copenhagen are now free of export duty.

Egypt.—Benzine and mineral lubricating oil pay customs duty at the rate of 15 per cent. *ad valorem.*

Federated Malay States.—An export duty of 2½ per cent. *ad valorem* has been levied, as from January 1, on china clay, potash and soda felspar, and china stone.

France.—The export of glucose and of certain kinds of rags is now permitted.

Germany.—Among the articles that may be imported without licence, as from April 29, are cork, tanning barks, certain raw hides and skins, raw bones, iron ore, manganese ore, ozokerite, and montan wax.

As from April 29 export licences are no longer required for cork, certain tanning barks, rubber, gutta percha, balata, ozokerite, montan wax, sulphite lyes, soft soap, turkey-red oil, "Creolin," glycerin, paraffin ointment, cart grease, copper sulphate, cryolite, artificial resins, tanning extracts, glue, asbestos manufactures, wire rope, aluminium powder and foil, lead bars, sheet zinc, etc.

Gold Coast.—The import duties on spirits have been revised with effect from April 27.

Japan.—The proposed changes in the import tariff affect, *inter alia*, olein, stearin, paraffin wax, caustic potash and soda, sodium peroxide, potassium, cocaine, cocaine hydrochloride, spiegeleisen, ferromanganese, certain kinds of iron, steel and zinc.

Kenya.—The import of spirits is prohibited unless they have been matured by storage in wood for at least 3 years.

Netherlands.—It is proposed to increase the import duties on beer, candles, chocolate, cork, gunpowder, oil (not specially mentioned), platinum, refined salt, soap, sugar. dextrose, caramel, wood spirit, and alcohol.

Nigeria.—Among the articles of which the import by post is prohibited are German dyestuffs and spirituous liquors.

Poland.—The customs duties have been suspended until July 15 on condensed milk, fertilisers, train oil, margarine, graphite, antimony, sodium sulphate, sulphuric, nitric and hydrochloric acids, dye earths, tanning extracts, pig iron, copper ingots, lead ingots, wood pulp, printing paper, and manilla cord.

Reduced rates of import duty are payable on olein, leather for the textile industry, asbestos sheet and yarn, certain wares of glass and porcelain, hydrosulphite and sulphide of soda, nitrates of thorium, cerium, beryllium, aluminium and magnesium, naphthols and sulphonic derivatives, and sulphuric ether.

Spain.—The export of 20,000 metric tons of olive oil is allowed under licence subject to export duty.

The customs duties on cement have been reimposed as from May 3.

Switzerland.—The import of certain wares of iron, copper and copper alloys is prohibited except under licence as from May 3.

All goods may now be exported under general licence with exceptions which include condensed milk, iron filings or turnings, scrap iron, indigo and coal-tar colours not specially mentioned in the general tariff.

Trinidad and Tobago.—The complete schedules of customs duties are set out in the issue for May 12.

Goods that are free of import duty under the British preferential tariff include blasting gunpowder, butter substitutes, some cattle foods, raw cocoa, coconuts,, certain kinds of glassware, raw rubber, balata, chicle, raw hides and skins, lard, lard substitutes, lime, manure, condensed milk with not less than 7 per cent. of fat, copra, edible oils, scientific apparatus, certain tanning and dyeing materials, tonca beans, serums, and radium.

COMPANY NEWS.

BRITISH COTTON AND WOOL DYERS' ASSOCIATION, LTD.

The twenty-first annual meeting of the Association was held in Manchester on May 13. Mr. A. Hoegger, who presided, said that few would care to experience a repetition of the abnormal conditions which had prevailed during the last six months, or again share in losses similar to those sustained by the textile industries in consequence of the great and sudden fall in prices. Since November last few of the branches of the Association had been able to find work for their employees for more than two or three days a week, but relations with labour continued very cordial; the standard rate of wages for the 48-hour week rose to 80s. 2d. in February last, but had recently been reduced to 70s. 6d.; pieceworkers could earn far higher wages. A comparison of costs for the years ended March, 1914 and 1921, showed that the cost of dyewares had increased by 270 per cent., that of coal by 217 per cent., and that of wages by 196 per cent. Recently there had been a revival of inquiries for all classes of work dealt with by the Association, and, given more settled labour conditions, the textile trades should once again enter upon a period of prosperity.

Referring to the dyestuff situation, Mr. Hoegger quoted the official report which stated that the value of imported coal-tar colours from Jan.—June, 1920, exceeded £5,000,000. Germany, he said, was now making dyes at the rate of about 5000 tons per month, and it had been estimated that the world's output capacity was at least double that of the normal consumption. Excellent work was being done by British makers, but we were not yet entirely independent of Germany; during the past year many good and useful colours not previously made in this country were marketed, but the prices of the vat and other fast dyes were still too high to allow of an extensive business being done. Great progress was necessary to enable our textile trades to meet the ever-increasing competition in dyed and coloured woven goods and prints containing the brilliant and fast dyes so much admired and in such great demand all over the world.

MAYPOLE DAIRY CO., LTD.

Sir W. George Watson, addressing the annual meeting held in London on May 18, said that the increased cost of labour and shorter working hours had greatly augmented manufacturing and distributing expenses, and that it would be impossible to maintain present wages and hours unless output and efficiency could be increased or more mechanical work adopted. Already the directors had considered the advisability of closing down certain departments in the factories, as foreign manufactured oil, margarine, etc., could be bought at lower prices than they could be manufactured in this country. The best "Maypole" margarine was now being retailed at 8d. per lb., compared with 1s. 1d. in December last. There had been a large increase in turnover during the past year, but the profit was less than 3 per cent. on the value of the goods sold—£36,500,000. The difficulties of trading when market values were constantly changing was illustrated by the necessity of having to purchase and carry at least 30,000 tons of crude oil three to six months before it could be delivered. During last year the price of crude oil fell from £100 to £70 per ton and the decrease in value would have seriously affected last year's results had it not been possible to reclaim some of the excess profits duty paid in recent years.

Fanti Consolidated Mines, Ltd.—In his address at the annual meeting held on May 12, Mr. Edmund Davis, chairman, said that it had been decided to expend £250,000 in developing and equipping the company's manganese proposition in West Africa, and that a contract had been entered into for the sale of 500,000 tons of ore at a guaranteed minimum profit of 7s. 6d. per ton. Although no washing-plant had yet been erected, 85·4 per cent. of the output had averaged 49 per cent. or over of manganese. Development work during the past year indicated that previous estimates of the extent of the ore deposits were likely to be exceeded. In his opinion the manganese deposits, which were valued in the company's books at £1000, were worth the entire capital of the company (£540,000).

New Capital Issues.—*Brunner, Mond and Co., Ltd.*—The issue at par of 2½ million 7½ per cent. cumulative preference shares of £1 each was quickly oversubscribed and the shares quoted at a premium. The money provided by this issue will be used to repay advances towards the construction of large works now being erected for the manufacture of soda ash at Wallerscote, near Winnington, for the nitrogen works at Billingham, Stockton-on-Tees, for workmen's houses, and for further working capital.

The United Glass Bottle Manufacturers, Ltd., has offered £600,000 seven per cent. first mortgage debenture stock (free of income tax up to 6s. in the £) at par; the proceeds of the issue will be spent on constructional work at the Charlton factory, etc.

LEGAL INTELLIGENCE.

Customs Seizure of Pyrogallic Acid. *Attorney-General* v. *Brown.*

In the Court of Appeal on May 10, Lords Justices Bankes, Warrington and Scrutton by consent allowed an appeal (upon terms not stated) by the Crown against a judgment of Mr. Justice Sankey delivered on December 7, 1919 (*cf.* J., 1919, 481 R). The suit was by the Crown, by information, for the condemnation of six packages of pyrogallic acid consigned to and imported into Manchester by the defendant, Mr. John Brown, trading as Brown and Forth, chemical manufacturers, of Manchester and London. The goods were seized on August 29, 1919, under a Proclamation dated June 25, 1919. Mr. Justice Sankey held that the Proclamation was illegal and invalid and entered judgment for the defendant with costs.

The Attorney-General now stated that the case was met by Section 4 of the Indemnity Act, 1920, and counsel for the defendant intimated that he could not contest that proposition.

Dispute Over Zinc-oxide Recovery Plant. *Keeling and Walker, Ltd.* v. *The Sturtevant Engineering Co., Ltd.*

In the Court of Appeal on May 9 and 10, before Lords Justices Bankes, Scrutton, and Warrington, Messrs. Keeling and Walker, Ltd., chemical manufacturers, appealed against an order of the King's Bench Divisional Court and a judgment of the Official Referee disallowing their claims against Messrs. The Sturtevant Engineering Co., Ltd., of London, for damages for the alleged failure of a zinc-oxide recovery plant supplied by them (*cf.* J., 1920, 403 R).

Counsel for the appellants stated that the respondents claimed that the contract was merely for the sale of goods, but his clients contended that it was also for design and labour, and these could not be taken back. For the respondents it was admitted that they had to return the purchase price, but as the appellants had cut up the cooling-plant there should be some deduction on that account.

In giving judgment, Lord Justice Bankes held that the Official Referee was right in taking the view that the respondent company was entitled to succeed. The Divisional Court agreed with that view, but referred the matter back to the Official Referee, as there was more than one contract and different considerations might apply to the cooling plant. The respondent company had taken back the suction plant and was therefore under no obligation to pay damages, but it must return the purchase price. The judgment of the Official Referee would stand in respect of the suction plant, but if the parties could not come to an agreement as regards the cooling plant, the matter must go to the Official Referee.

REPORTS.

Report on the Economic, Financial, and Industrial Conditions of Finland in 1920. *By* C. H. Mackie, *H.M. Consul, Helsingfors. Department of Overseas Trade. Pp.* 44. *London: H.M. Stationery Office.* 1921. *Price* 1s. *net.*

Finland was declared an independent sovereign State in December, 1917, and a Republic in July, 1919, and it was only after the latter event that the country began to recover economically. The progress made has been marvellous. With a total population of only 3,331,814 (January, 1919), mostly engaged in agriculture, Finland is one of the most prosperous of the smaller European States, a position which it owes mainly to the timber and pulp and paper industries (*cf.* J., 1921, 71 R). The latter made good progress in 1920 (figures of production for the whole year are not yet available), but the trade in timber was chequered. All business was adversely affected by the fluctuating rate of exchange; the official rate in London varied between 65·70 Finnish marks to the £ in March to 180 marks at the end of November, the average rate being about 102 marks (par value 22·25 mk.). Rapid progress is reported in the leather industry, which now comprises 26 tanneries and eight shoe factories. In spite of restrictions on imports and depreciated exchange, hides were imported to the value of 70 million Finnish marks. Among new developments to be noted are the erection by the Government of a sulphuric acid and superphosphate factory at Kotka, with a capacity of 20,000 t. of superphosphate per annum; the rebuilding of the Kotka cellulose factory for the manufacture of easy-bleaching sulphate pulp; a paper mill with an output of 12,000 t. of strong wrapping paper has been completed at Björneborg, and at the same place a sulphite-pulp mill capable of producing 14,000 t. of pulp per annum is nearing completion. A large hydro-electric station is being built at Aetsa to supply about 7000 h.p. to the industrial establishments at Björneborg, some 70 km. distant.

The import and export statistics given in the report cover the first nine months of the year. During this period Germany supplied the bulk of the dyes and colours and had rather more of the trade in drugs and chemicals than had Great Britain, but the United States had the greatest share of this trade. Great Britain was the largest supplier of gums, asphalt, resin, rubber, hides, minerals and manufactures thereof, perfumery, textiles, thread, and twine. Sweden, Germany, and the United States are our chief competitors, Sweden supplying mainly metals, enamelware, and machinery, and the United States chiefly oils and fats, machinery, gums, asphalt, etc., and hides.

A summary of the trade returns for the whole of 1920 is given in the *Board of Trade Journal* for March 24. These show that although imports still exceeded exports the position in this respect has very much improved. The following are the values in millions of Finnish marks:—

	Imports. 1920.	Exports. 1920.
Total for the year	3620·4	2906·6
Chemicals and drugs	169·5	1·2
Colours, etc.	43·9	0·2
Explosives	9·3	19·4
Fertilisers	21·4	—
Ether, alcohol, etc.	5·3	2·6
Oils, fats and waxes	197·0	1 5
Asphalt, tar, resin, rubber, etc.	81·7	6·5
Minerals and their products	156·5	5·0
Metals and manufactures	529·8	4·8
Skins, furs, leather	121·9	38·1
Paper pulp, cardboard, etc.	6·3	1080·7
Wood and wooden goods	16·0	1633·4

Further statistics supplied by H.M. Consul show that Great Britain headed the list in the import trade with about 28 per cent., the United States was second with about 21 per cent., followed by Germany with 17, and Sweden with 10 per cent. respectively. The United Kingdom's share of the Finnish export trade was 43 per cent.

THIRTY-EIGHTH REPORT OF THE COMPTROLLER-GENERAL OF PATENTS, DESIGNS, AND TRADE MARKS, 1920. *London: H.M. Stationery Office.* 1921. *Price 2d. net.*

The volume of business done by the Patent Office during 1920 again showed a substantial increase, though not to the same extent as in 1919 (*cf.* J., 1920, 292 R), the total number of patent applications filed being 36,672, or 3819 more than in 1919, when the increase amounted to 11,014. Although more patent applications were filed than in any other year, a considerable proportion of the increase was due to the many foreign applications made under the Peace Treaties. Thus, Convention applications made under the extensions of time granted by the Peace Treaties and the Berne Agreement of June 30, 1920, were largely responsible for the increase of 49 per cent. in the number of complete specifications filed on application; the number of complete specifications filed after provisional specifications decreased slightly. Designs applications numbered only 13,669, or 425 less than in 1919, but trade-mark applications, with a total of 14,064, showed a gain of 1585, and were well above the pre-war level. There was a further substantial increase in the business transacted; 263,000 letters and correspondence forms and 92,000 parcels of publications were dispatched, and 260,368 patent specifications sold.

The number of hearings upon oppositions to the grant of patents was 43, and there were seven appeals to the Law Officer; 1550 hearings were given under Sections 7 and 8 of the Acts, with three appeals to the Law Officer.

Altogether 120,512 readers made use of the Library, the increase of 21,894 possibly being due to some extent to the extension of the hours to 9 p.m. The Library, which was being re-classified, contained 59,394 works (183,675 volumes, exclusive of duplicates).

The sum of £420,472 was received for patents fees (renewals £277,500), and £8690 and £39,295, respectively, for designs and trade-marks fees. Total receipts amounted to £487,543 8s. 9d. and total expenditure to £401,036, the balance representing about 18 per cent. of the total receipts.

TRADE NOTES.

BRITISH.

The Fertiliser Trade in South Africa.—The use of fertilisers in South Africa was steadily increasing until conditions arising out of the war greatly reduced importation. The decline in importation is illustrated in the appended table, which gives the imports in 1913 and 1919, and the percentages supplied by the chief countries of origin:—

	1913.		1919.	
	Long tons.	Per cent.	Long tons.	Per cent.
Basic slag	5,330	Ger. 43, Belg. 22, Holl. 21, U.K. 14	1,714	Holl. 100
Bone fertilisers	4,209	Ger. 27, Ind. 22, U.K. 21, Holl. 14, Russ. 12	112	Arg. 87, Ind. 8, U.K. 2
Guano	313	Seychelles 73, U.K. 15	1,778	S.W. Protect. 76, Falk. Is. 23
Nitrate of soda	65	Ger. 61, Chile 31	—	—
Phosphate, raw	680	Ger. 68, U.K. 20, Belg. 8	5,852	Egypt 96, S.W. Protect. 4
Potash fertilisers	1,739	Ger. 78, U.K. 7, Ind. 6	406(lb.)	U.K. 100
Sulphate of ammonia	366	U.K. 92, Ger. 8	—	—
Superphosphates	36,619	Holl. 66, Ger. 19, U.K. 7	740	U.K. 100
Whale manures	—	—	9,056	Falk. Is. 100
Other fertilisers	7,665	U.K. 51, Holl. 35, Ger. 11	13	Nor. 45, Swed. 41, U.K. 14

The fertilising constituents required by South African soils are, in order of importance, phosphoric acid, lime, nitrogen, potash.—(*U.S. Com. Rep., Mar.* 18, 1921.)

Sierra Leone in 1919.—Although the trade of this Colony was satisfactory in 1919 and showed signs of expansion, there was much distress among the inhabitants owing to the shortage of food and the increased prices of imported goods. Towards the end of the year conditions improved owing to better prices being obtained for palm kernels and palm oil, which were produced and exported in much larger quantities than in former years. The crop of kola nuts was also larger, and the higher prices obtainable in Europe for piassava caused this commodity to be shipped in larger quantities, although the actual export is almost insignificant in comparison with the vast amount of raw material available. The gum copal reserve in the Kessewe Hills and four areas in the Ronietta district were opened to gum collectors during the year. So far as is known the mineral resources of Sierra Leone are very small; there are, however, deposits of laterite iron ores which would be valuable if a process for treating titaniferous iron ores were available. Various products of the Colony were examined by the Imperial Institute. Po-yak nuts (*Parinarium* sp.) were found to yield a drying oil similar in value to tung oil, and a meal with a lower protein content than is usual in oilseed residues; both nuts and oil should be readily saleable in the United Kingdom. Rowe fibre was also examined, and reported to be very coarse, harsh, interlaced, and only suitable for making heavy-sized yarns or coarse string and rope. Imports were valued at £2,034,780 and exports at £2,101,569, both showing large increases over the preceding year. The chief exports were:—Palm kernels, 50,622 tons; palm oil, 828,750 galls.; kola nuts, 2995 t.; ginger, 1069 t.; and piassava, 1059 t.—(*Col. Rep.-Ann., No.* 1065, *Mar.*, 1921.)

FOREIGN.

The Dutch Oleomargarine Trade in 1920.—Despite the general trade depression and wide variations in prices, the exports of margarine from Holland during 1920 showed a notable increase, much of which was due to the development of new markets. The anticipated increase in trade with Germany did not materialise, but Great Britain took very much more of the output than formerly. The exports of oleomargarine and butter substitutes in 1919 and 1920 were 53,881 and 92,883 metric tons, respectively, the percentages taken by the principal consumers during the two years being as follows:—United Kingdom, 48 and 55; Germany, 46 and 33; Belgium, 4 and 2; Czechoslovakia, 5 (1920 only). The raw materials are obtained mainly from the United States or through firms in other countries which are controlled by American capital.—(*U.S. Com. Rep., Mar.* 24, 1921.)

REVIEWS.

LEHRBUCH DER FARBENCHEMIE. *By* DR. HANS. TH. BUCHERER. *Second edition, revised. Pp. xii.+* 636. (*Leipzig: Otto Spamer.* 1921.) *Prices: unbound* 47*s.* 1*d., bound* 51*s.*

It is a far cry from Dr. Bucherer's modest little booklet of 1904 in the "Sammlung Göschen" to the present imposing volume, but it indicates that the lines originally laid down by the author have proved to be sound under the test of experience. The second edition of Prof. Bucherer's larger work differs but little from the original 1914 edition except that it is slightly longer (636 as against 557 pages), whilst the text has been revised and some new matter added, but all the excellent features which distinguished the former edition are retained, so that the text-book still remains one of the best of its kind for students of colour technology. The section dealing with the anthocyans is entirely new, but in spite of the large amount of work done by English chemists on this class of colouring matters, almost the only name mentioned is that of Willstätter, and the same tendency to ignore the work of non-Teutonic chemists is noticeable in the "Literatur Verzeichnis" (on pp. 602—636), by means of which the author has sought—though not very successfully—to meet the objection that no literature references were given in the first edition to enable the student to follow up any matter of special interest.

One cannot help feeling that the authors of German works on organic chemistry must sometimes be in the habit of saying to themselves "Organic chemistry is a German Science, founded by Liebig of immortal memory," and accordingly ignoring so far as possible the work of all scientists west of the Rhine. This tendency is also noticeable in the section on the cyanine and other sensitising dyes, where the important work of English and American chemists on the subject such as Adams, Mills, Wise and others is altogether diregarded, with the result that several of the formulæ quoted by Bucherer stand in need of revision in the light of the most recent research. The list of references already noted is a step in the right direction, but still needs considerable improvement before it can be regarded as satisfactory.

The statement on p. 493 apropos of the decrease in the acreage under indigo cultivation in India during 1916–18 is illuminating:—"Die mit Indigo bebaute Fläche nahm in ganz auffallendem Masse ab, offenbar vor allem infolge der grossen, durch den U-Boot Krieg verursachten Schwierigkeiten, den Farbstoff über See zu verfrachten." We are afraid these lines were penned whilst the eminent German author was still feeling the after-effects of "U-Boot Fieber," and that he will find the cause of the decrease to be a good deal nearer home, say, in the neighbourhood of Ellesmere Port!

In the chapter on the Natural Dyes the recent work of Dimroth and his pupils on carminic and laccaic acids is discussed, but no mention is made of von Lampe's synthesis of Curcumin in 1918 in the section dealing with that colouring matter.

The addition of marginal rubrics makes the second edition somewhat handier than its predecessor, but the use of italics or other distinctive type for sectional sub-headings would be a great advantage. Most of the defects noted are, however, but slight, and the second edition cannot but enhance the reputation already won by the 1914 edition.

F. A. MASON.

ANTHRACENE AND ANTHRAQUINONE. *By* E. DE BARRY BARNETT. *Pp.* 436. (*London: Baillière, Tindall and Cox.* 1921.) *Price* 27*s.* 6*d. net.*

Since the publication, many years ago, of Auerbach's "Anthracen" (1880), a work which is probably unknown to the younger chemists of the present day, no attempt has been hitherto made to collect in book-form an account of the varied reactions of this hydrocarbon and its derivatives. In the interim an extraordinary amount of new matter has accumulated on this subject, much of which is only to be found interspersed among the foreign patent literature, not easy of access to the average student and, moreover, involving search of a tedious character. The appearance of Mr. Barnett's book is thus greatly to be welcomed, and this should prove to be of much service not only to colour chemists, but to students of organic chemistry in general. The volume of approximately 400 pages is divided into eighteen chapters:—I. Introduction; II. Anthracene and its Homologues; III. Simple Anthracene Derivatives; IV. The Anthraquinones and Dianthraquinonyls; V. Anthrone, Anthranol and Allied Products; VI. Anthraquinone Ring Syntheses; VII. The Benzanthraquinones; VIII. The Aldehydes, Ketones and Carboxylic Acids; IX. The Nitro, Nitroso and Halogen Anthraquinones; X. The Sulphonic Acids, Mercaptans and Sulphides; XI. The Amino Anthraquinones and Dianthraquinonylamines; XII. The Hydroxy and Amino Anthraquinones and Ethers; XIII. Pyridine and Quinoline Derivatives; XIV. The Acridones, Xanthones and Thioxanthones; XV. The Benzanthrones; XVI. The Cyclic Azines and Hydroazines; XVII. Miscellaneous Heterocyclic Compounds; XVIII. Miscellaneous Compounds; and there are, in addition, addenda and an index of German patents.

The book contains a very large amount of information from the scientific aspect which is well arranged and has without doubt involved considerable labour on the part of the author. On the other hand, one feels that the subject matter is, if anything, of too condensed a character, and might perhaps be more easily assimilated had it been spread over two volumes of about the present size. It appears a pity that in a work of such importance but four and a half pages are devoted to a historical sketch of the subject, and that more attention is not given to the earlier history of the synthetical manufacture of alizarin. References to Schultz and Auerbach hardly meet the case (and, indeed, is not the latter out of print?), for these authors are not entirely unbiased and do not inform one that the successful production of the Alizarin Reds was carried out in this country by Perkin by the dichloranthracene method (a process not alluded to by the author) for some time before they were economically obtained in Germany. Again justice is hardly meted out to the latter, there being no mention of his discovery of anthrapurpurine, 4-amino-alizarin, bromo-alizarin, or of his work on anthraflavic acid and the dibromanthraquinones. Though the book will be found useful for purposes of reference and, indeed, contains an account of the more recently discovered reactions of importance, there are one or two minor omissions, such as, for instance, the hydroxyanthraquinone-β-carboxylic acids, β-methyl alizarin, anthraquinone oxide, etc., though this may perhaps well be the case when there has been so large an amount of material for collection. The statement on page 253 that anthraquinone sulphonic acid on fusion with alkali gives an alizarin containing as impurity higher hydroxylated anthraquinones is hardly correct, as the commercial dyestuff carefully prepared from the β-monosulphonic acid salt contains only alizarin as colouring matter. Again (page 254), though a pure alizarin can be prepared by the alkali fusion of anthraquinone according to the patented methods, it is easy also in this case, if due precautions be not taken, to obtain it contaminated with higher hydroxylated products. It is difficult to see that the employment by the author of his modification of Pfaff's system of notation throughout the book is of advantage, for this does not economise space, and is only likely to confuse the less experienced reader. Frequently, again, these formulæ, as for instance on page 318, give one the impression of pentavalent carbon, and it is difficult to understand why α β compounds of this and allied types should be represented by diagonal lines, whereas with the ββ derivatives parallel bonds clearly indicating tetravalent carbon should be used (p. 317).

Reference to German patent numbers are naturally numerous throughout this work, but it would have been a greater boon to the student had these been either supplemented or replaced by statements as to the volume and page where they occur in Friedländer.

The book is well up to date, bears evidence of careful search by the author, and should prove of assistance to many investigators. It is, however, sad to see among the enormous variety of facts it contains how few have emanated from work carried out in our own country.

A. G. Perkin.

Silica and the Silicates. *By* J. A. Audley. *Industrial Chemistry Series, edited by* S. Rideal. *Pp. xiv.+374. (London: Baillière, Tindall, and Cox.* 1921.) *Price 15s. net.*

Students on being introduced to the consideration of the industrial applications of silicate chemistry often ask to be directed to some suitable book in English dealing with the subject, and it is not easy to comply with the request. It is possible to recommend works giving descriptions of manufacturing processes, but none which, at the same time, emphasises clearly the underlying scientific principles. The title of the book under review raised hopes that this gap in the literature of silicate chemistry might be bridged, for it immediately suggested parallelism with H. le Chatelier's "La Silice et les Silicates." But although the author has drawn on his experience as a ceramic chemist, and on a great accumulation of knowledge, he does not write with the scientific insight and confidence of an investigator nor with any great insistence upon essentials.

The book is divided into six sections, the first dealing with the various modifications of silica, their natural occurrence and artificial production. It is rather surprising to find the regions of stability of the different forms of silica discussed without any reference to the well-known and comparatively recent work of Fenner on this subject, particularly as space is found to mention several old investigations on the artificial production of quartz crystals. At present the stability ranges of the various modifications of silica are debated keenly. They are by no means definitely established, and the subject calls for very careful treatment if confusion is to be avoided. We find it stated:—

(1) Without any qualification that "tridymite is the stable variety of silica above 1500° C." (p. 36);

(2) that "the temperature is about 1600° C. where the transformation into tridymite takes place" (p. 33);

(3) that cristobalite "thus differs from tridymite both by its birefringence and its point of transformation 400° higher" (p. 34); and

(4) that "Tridymite is not known to be formed under any conditions above 1470° C."

The reader must take his choice. A reference on p. 42 to the impossibility of determining by means of optical investigation whether silica obtained from calcining hydrated silica is crystalline or amorphous might be brought up to date by mentioning the possibility of settling this point by the X-ray method of crystal analysis of powders. Kyropoulous has concluded in this way that amorphous silica shows no evidence of regular, internal structure, but after calcination at 1300° C. the interference bands characteristic of cristobalite appear.

The properties and uses of natural and artificial silicates are discussed in the next part, whilst the third section is devoted to lime, cement, and mortar. Good descriptions of the manufacturing processes are given, but a fuller reference in the text to the diagrams of the various plants would be useful to many readers who are unfamiliar with the industry. This is also true of other sections of the book, almost a complete page being devoted, for example, to diagrams of the Stein tank furnace with no specific reference to it in the text.

The fourth section deals with the ceramic industries, and a very readable account is given of pottery and brick manufacture, together with passing references to more special non-silicious refractories. The earlier remarks with regard to the subordination of the scientific aspect of the subject are illustrated in this section. For example, in a discussion of the fusibility of clays no reference is made to Raoult's law, eutectic mixtures, or to Ludwig's work on this question.

Section five discusses glass and enamels, and considers the raw materials, the composition and properties of various types of glass and enamels, glass furnaces, etc. The last section is devoted to some miscellaneous applications of silicates.

The descriptions of methods of manufacture are clear and concise, and the book will be of use without completely satisfying the demand for an English text-book giving a scientific exposition of the silicate industries. The conclusions of many investigators whose work has appeared in recent years in the journals of the English and American Ceramic Societies and the Society of Glass Technology are summarised. This feature of the book will be very valuable to those who have not the time or opportunity to consult these journals. The references to the results of continental workers are not so numerous. Both the text of the book and the diagrams are well produced, and short bibliographies are given at the end of each section and at the end of the book.

Summarising, this work is full—even crowded—with information both as to the occurrence and properties of raw materials and as to manufacturing processes. It gives also the results obtained by many investigators on many branches of the subject. It loses grip, as do so many technological and scientific books of the present day, by overlaying essentials with more or less relevant detail and in refusing to select or decide—a method of treatment which has both advantages and disadvantages, but is more informing than stimulating.

John W. Cobb.

OBITUARY.

BERTRAM BLOUNT.

The death of Bertram Blount on April 9, at the age of 54, has removed a well-known member of the chemical profession and of this Society. Educated at King's College, London, under C. L. Bloxam, he started practice with W. H. Stanger, and continued independently when that partnership was dissolved. He devoted himself more especially to engineering chemistry, and in collaboration with A. G. Bloxam published a book on "Chemistry for Engineers and Manufacturers," whilst his individual publications "Cement" and "Practical Electrochemistry" are also well known. On both these subjects he was a widely-recognised authority, and at the time of his death he was editing a series of books on Electrochemistry, two volumes of which have been already published. He was also the author of papers on the "Determination of Oxygen in Commercial Copper," "Vacuum Balance Cases," "The Limitations of the Balance," and other subjects. Blount enjoyed an extensive consulting practice, and was frequently called as an expert witness in chemical law cases. Of marked individuality and characteristic manner, he was not readily forgotten by those with whom he came in contact, and it is a subject for regret that he should have broken down at so early an age.

EDMUND JAMES MILLS.

Prof. E. J. Mills, who died on April 21 last, was born in London on December 8, 1840. He was educated first at the Grammar School, Cheltenham, and then at the Royal School of Mines, where he took the courses of instruction for a degree in science at London University, at that time the only university in Britain granting such degrees. He graduated B.Sc. in 1863, and obtained the doctorate in 1865. There were few candidates for science degrees at that time, and on looking at the list of graduates it is interesting to note that Mills's name appears about equidistant in time between those of Prof. Alex. Crum Brown, in 1862, and Sir William Tilden, in 1871.

In 1861 Mills became assistant to Dr. John Stenhouse, and a year later was appointed one of the demonstrators in chemistry at Glasgow University, in which capacity he conducted tutorial classes for medical students, a work not very congenial to him, and one which, from his temperament, he was not particularly well fitted; he was, however, a good laboratory teacher for advanced students. He resigned this appointment in 1865. In 1875 Mills became superintendent of the "Young Laboratory," in Anderson's College, Glasgow, and during his term of office, about the year 1886, that foundation, together with Anderson's College, became incorporated in the Glasgow and West of Scotland Technical College, the Young Laboratory appointment being converted into the Young Chair of Technical Chemistry. His predecessors in charge of the Young Laboratory were W. H. Perkin, sen., 1870–71, and G. Bischof, 1871–75.

Mills was the author of many papers covering a wide field of work. Although his first recorded paper in the Proceedings of the Royal Society (1860) is upon brom- and chlor-phenylamine, his early work inclined more to general and inorganic chemistry, dealing with subjects such as isomerism, statical and dynamical ideas on chemistry, chemical equivalents, etc., and this tendency is seen also in his later papers in the Philosophical Magazine, published during 1883, '84, and '87. In the Journal of the Chemical Society his more important papers are:—"On Aniline Derivatives and Nitrotoluene" (1875–76); "On Potable Waters" (1878–81); "On Chemical Repulsion" (1880–81); "Melting-points" (1882). From 1879 to 1882 he published "Researches on Chemical Equivalence"; from 1878 to 1880 papers on "The Action of Oxides on Salts"; and later, "Researches on Dyeing," in conjunction with Louis Campbell. To the Society of Chemical Industry he contributed papers on the "Quantitative Estimation of Oils and Fats" (1883), "Viscosity Determinations" (1886), and "Oxidation of Aniline" (1894). In his books Mills did not confine himself to purely scientific matters, for, in addition to two works, "Fuel and its Applications" (published conjointly with E. J. Rowan in 1889) and "Destructive Distillation" (1892), he wrote a volume of poems "My Only Child" (1895), and "The Secret of Petrarch" (1904).

Mills was elected a Fellow of the Royal Society in 1874, and was an honorary LL.D. of Glasgow University; he was an original member of the Society of Chemical Industry and served on the committee of the Glasgow Section, including two periods as vice-chairman, from 1884 to 1894; and was a member of the Council of the Chemical Society at various times from 1868 to 1906, serving as vice-president from 1912 to 1915. After retiring from his professorship in Glasgow in the early 'nineties, he returned to London and rendered valuable service as a member of the Library Committee of the Chemical Society.

J. Millar Thomson.

PUBLICATIONS RECEIVED.

Coke-Oven and By-Product Works Chemistry. *By* T. Biddulph-Smith. *Pp.* 180. (*London: Charles Griffin and Co., Ltd.* 1921.) *Price* 21*s.*

Bibliography of the Activated Sludge Process of Sewage Treatment. *By* J. E. Porter. *Second edition. Pp.* 117. (*Rochester, N.Y.: General Filtration Co., Inc.* 1921.) *Price* $1.00.

The Chemists' Year Book, 1921. *By* F. W. Atack *and* L. Whinyates. *Vol. I., pp.* 422; *Vol. II., pp.* 423—1142. (*Manchester: Sherratt and Hughes.* 1921.) *Price* 21*s.*

The Elements of Vegetable Histology. *By* C. W. Ballard. *Pp.* 246. (*New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.* 1921.) *Price* 18*s.*

Die Elektrometrische Massanalyse. *By* Dr. E. Müller. *Pp.* 110. (*Dresden and Leipzig: Theodor Steinkopff.* 1921.) *Price: paper,* 8*s.* 3*d.*

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DANGEROUS DRUGS.

As a result of the criticisms which were directed against the draft Regulations issued under the Dangerous Drugs Act (*cf.* J., 1921, 79 R, 139 R), the Home Secretary appointed a Committee to consider the outstanding objections and to advise on modifications. The Report of this Committee, which has just been issued (Cmd. 1307, 3d.), shows that witnesses were heard on behalf of the British Medical Association, the Pharmaceutical Societies of Great Britain and Ireland, the Drug Club, Fine Chemical Manufacturers' Associations, the Central Chamber of Agriculture, the Association of Public Analysts of Scotland, and twenty-four other allied bodies. After consideration of the evidence, the Committee has recommended certain further modifications and additions which it claims will "almost entirely remove" the objections to the original draft.

In our issue of April 30 last we pointed out that the draft Regulations overlooked the fact that the drugs in question were constantly used in chemical, physiological, pharmacological and other laboratories, and that no provision was made for their possession and use by the experts in charge of such institutions. An attempt, which cannot be regarded as completely successful, has been made to remedy this defect in the revised regulations. In Article 11 it is stated that " . . . any person in charge of a laboratory for purposes of research or instruction attached to any university, university college, public hospital or other institution approved by the Secretary of State for the purpose, or any person appointed by a local authority with the approval of the Minister of Health as an analyst for the purposes of the Sale of Foods and Drugs Acts, 1875 to 1907," is authorised to be in possession of and to supply the drugs concerned so far as is necessary for the practice of his profession, but subject always to the provisions laid down in the Regulations. Hence scientific institutions which are not "attached" to a university, university college, or public hospital will apparently need "approval" by the Home Office before they can secure a licence, and the same applies to all independent workers such as analytical, consulting and other professional chemists who are not officially-appointed public analysts. This means that such institutions as the Finsbury Technical College, the Imperial College of Science, the Davy-Faraday Laboratory, and the Lister Institute need "approval" before they can possess and use these drugs for research, and that independent workers like the late Sir W. H. Perkin can only secure such a privilege by attaching themselves to a university or a hospital or by becoming public analysts.

Assuming that no further revision will be made, it is to be hoped that the necessary licences will be readily granted to *all* genuine research workers, and a letter from the Home Secretary to the Parliamentary Committee of this Society seems to suggest that this course will be pursued. In the letter, dated April 27 last, it was stated that the Home Secretary "would be prepared to consider sympathetically all applications for licences thereunder from applicants who require to use the drugs for the purpose of *bona fide* research"; nevertheless, we fail to see the necessity for imposing even such a modified restriction on scientific research and for compelling research workers to submit to the delays and vexations which are invariably associated with applications to Government departments.

There are other considerations which, if of less interest to the majority of our readers, are nevertheless of much importance to our pharmaceutical colleagues.

The Committee could not agree to the request that the requirements of a prescription for the sale of the particular drugs named in the Act should be completely withdrawn, but a list of exemptions has been prepared and inserted as a schedule to the Report. This schedule exempts two well-known and popular remedies—Dover's Powder and gall-and-opium ointment—and fifteen other official and unofficial remedies, none of which, however, is used to any extent in medicine or pharmacy. The Committee ignores the point made by the Pharmaceutical Society that the prohibition is *ultra vires* on the ground that it can only be settled by competent judicial authority. Amendments are proposed to make it clear that dentists, veterinary surgeons, and medical practitioners can administer the drugs to their patients without writing a prescription or keeping a record, and the Pharmaceutical Society's suggestion that the prescription should bear the name and address of the person for whose use it is intended has been adopted. As an attempt to meet various objections from the British Medical Association, the Pharmaceutical Society, and the Drug Club, a new clause has been inserted regarding the marking of packages or bottles containing the specified drugs. Special regulations have been agreed upon concerning the application of the Act to hospitals and similar institutions, but the Committee has been unable to overcome the difficulty that the Regulations do not apply to preparations containing less than 0·2 per cent. of morphine or 0·1 per cent. of cocaine or diamorphine. It was demonstrated that a big bottle containing any one of the drugs specified in the Act of a strength below the limit fixed in the Regulations might actually contain more of the drug than a small bottle of the drug in a concentrated form; so that a person desirous of gratifying the drug habit can avoid the Regulations by purchasing a large bottle of the low strength. The Committee admits its helplessness and states that it cannot be blamed as it did not frame the Act! Again, the Committee fights shy of the submission on behalf of the Pharmaceutical Society (emphasised in a "Reservation" by Mr. W. J. Uglow Woolcock, a member of the Committee, and printed at the end of the Report) that if it is desirable for the protection of the public that a pharmaceutical chemist should be prohibited from dispensing any of these drugs without a medical prescription, it is equally desirable that these drugs should not be dispensed by the doctor who prescribes them.

LIQUID FUEL FOR STEAM-RAISING.

N. A. ANFILOGOFF.

There is no industry in which fuel oil cannot advantageously replace coal as a source of heat or power. In reverberatory furnaces, metallurgical furnaces, for electric-light-filament carbonisers, cement kilns, rivet forges, and even ordinary cooking stoves, fuel oil has been tried and proved to be more efficient than coal.

For steam-raising liquid fuel is, beyond compare, the more efficient fuel of the two. In the Lancashire boiler, for instance, a third of the length of the internal flues is divided in half by the fire-grates, and no heat at all impinges on the lower half. On the contrary, the cold air entering the ash-pit cools the boiler-plate where the layer of ashes does not insulate it. With fuel-oil firing the whole of the area of the circle of the flue is under heat, thus increasing or making more effective the available heating surface and greatly assisting the water-circulation. The intensely hot flame, which can be easily controlled, gives a more steady head of steam; and it may be asserted that in any factory where four boilers under coal fires can hardly carry the load, three only of these boilers under oil will suffice. This the writer has personally experienced. One must not forget that one man can quite easily look after four boilers under oil, whereas at least three men would be required if these boilers were hand-fired by coal. There is no cleaning of fires, trimming, or wheeling away of ashes with oil-fired boilers.

During the present coal crisis very many factories adopted oil as "the next best thing" at "whatever the cost," quote forgetting or not knowing that, as a matter of fact, they had been losing money, or, at least, failing to make the most economic use of their boiler-plant, by their previous use of coal.

Apart altogether from savings in many other directions, let us examine how the use of coal compares with that of oil. To-day's prices (or rather pre-strike prices) may be taken as 50s. per ton for coal and 90s. per ton for fuel oil. Examining theoretical values as a guide and taking calorific values, we get an average of, say, 14,000 B.Th.U. for coal and, say, 19,000 B.Th.U. for liquid fuel—that is, 1 of oil is equivalent to 1·4 of coal. Taking also theoretical evaporative values, we get, say, an evaporation of 11·8 lb. of water from and at 212° F. for 1 lb. of coal and 17·9 lb. of water from and at 212° F. for 1 lb. of oil, *i.e.*, in this respect 1 lb. of oil is equivalent to 1·5 lb. of coal. In practice, however, working on actual monthly consumption figures, the writer has hardly ever exceeded an evaporation of 8 lb. of water per 1 lb. of coal, and has invariably obtained an evaporation of 15·6 lb. of water per lb. of oil. These actual consumption figures therefore show that 1 lb. of oil will do the work of 1·95 lb. of coal. Translating these figures into cash values on comparative costs of fuel, we find that 1 ton of coal at 50s. evaporating 8 tons of water gives an evaporation-cost of 6s. 3d. per ton of water, whereas oil at 90s. evaporating 15·6 tons of water gives an evaporation-cost of 5s. 9d. per ton of water converted into steam.

Assuming that we are dealing with a factory employing four boilers, each capable of evaporating 7500 lb. of water per hour, we get the following interesting statement of comparative costs:—

Evaporation 72,000 galls. per 24 hours or 321½ t.

Evaporation cost.	Coal.			Evaporation cost.	Oil.		
321½ tons at 6s. 3d.	£100	9	4	321½ tons at 5s. 9d.	£92	8	7
1 Fireman at 2s. ..	2	8	0	1 Fireman	2	8	0
1 Assistant at 1s. 11d.	2	6	0				
1 Trimmer at 1s. 10d.	2	4	0				
	£107	7	4		£94	16	7

Thus there is a clear cash saving of £12 10s. 9d. per day. But without any such saving in cash, the advantages derived from greater efficiency of boiler-plant, ease of control and absence of ash, dust and dirt, in themselves would demand the change from coal to liquid fuel. We are, however, very, very conservative and afraid to make a departure from the methods employed by our fathers and grandfathers.

Speaking to a chemical manufacturer with a large business, the writer was given a reason why the chemical factory was still burning coal that seemed to him to sum up the position—he was told that boilers under coal have lasted 20 years or more, and that no one would come forward to guarantee the life of the boiler under oil. But neither would the boiler-maker guarantee the life of the boiler under coal fires except with the proviso that reasonable care must be taken. Now, in the words "reasonable care" lies also the mystery of success or failure in burning liquid fuel. The work falling on the fireman is so light and the control of the liquid fuel fires so easy, requiring, as it does, the turning of a valve-wheel, that there should be no excuse why the most punctilious care should not be bestowed on the boiler.

On the other hand, with oil fuel the whole of the flues of a Lancashire boiler, or the combustion-chambers of tubular boilers, are under equal heat, doors have not to be opened for stoking up, thus admitting gusts of cold air, so that there is no sudden periodic contraction which, under coal-firing conditions, has added not a little to the reduction of "life" in boilers. No reasonable care, however, can be taken of boilers if the man in charge has not sufficient knowledge to qualify him as a stoker, and the writer envies the works manager or engineer of a U.S.A. factory in this particular. No man there can take charge of a boiler unless he has qualified for and gained a certificate or licence, which has to be framed and exhibited in the boiler-room. In this country, unfortunately, anyone can and does "fire" boilers, but that same anyone absolutely must have a little tuition to fit him to look after oil-fired furnaces.

The difference between coal and oil as fuel lies in the fact that whereas in coal we have a fuel of which some 75 per cent. is burnt slowly on the grate as a solid, in oil we have a fuel the whole of which is burnt quickly as a heavy vapour. In the first case combustion must depend on grate-area, in the latter case it depends on combustion-area.

To get the most efficient results from liquid fuel, one must arrange for two essentials:—(1) The provision of means to convert the oil into a heavy vapour; (2) the provision of sufficient air to support combustion.

To convert the whole of the oil into vapour, as the term is ordinarily understood, would, of course, mean that a boiler or still must be provided in which the oil would be converted into vapour by distillation. This, however, is not necessary, as the oil is burnt in practice *not* as a "vapour," as the chemist understands the word, but rather as a heavy "mist" mechanically created. The instrument used for creating the mist is called the "burner," or "atomiser." The more finely the oil is atomised, the easier it mixes with air, and the easier, therefore, it ignites and burns.

In selecting an atomiser, the intending purchaser is faced with such an array of "systems" and "patent" burners that it is not surprising that he halts bewildered. In this country the best known are the "Wallsend-Howden," "Scarab," "White," "Kermode," "Korting," and "Holden." These are not enumerated in their order of excellence. The trouble is that each system is "the best," and the advocates of each insist on the installation of their *whole* system as absolutely necessary to achieve efficiency. Much nonsense is incidentally made use of further to bewilder the intending purchaser. One or other of the salesmen will impress you that in his system provision is made for superheating the air, which saves fuel and gives better combustion. Of course, air cannot be superheated. It is true that a slight preheating of the air aids the rapidity of combustion, but to use furnace heat, for instance, to preheat the air, and then to return that heat back to the furnace can only be purposeless transfer of heat (minus losses). It can accomplish nothing and can create nothing, just as stirring water cannot increase its quantity.

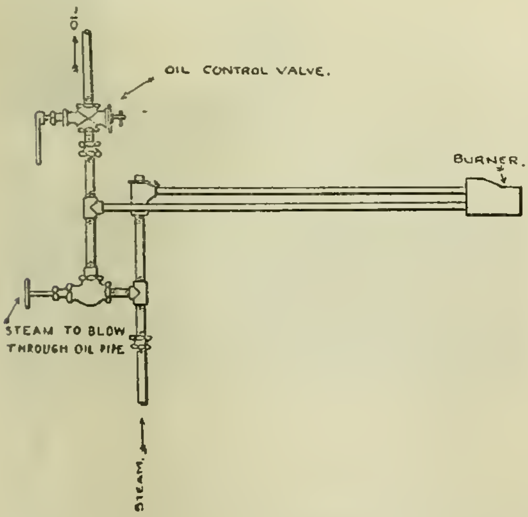
Then, again, some urge that their burners must work at a certain pressure, and that the oil must be at a certain temperature. This is also nonsense. There is no burner which will work equally well with any oil at fixed pressures and temperatures; so much depends on the composition and viscosity of the fuel itself. In the main there are two systems:—(1) That in which the oil under pressure is conveyed by more or less tortuous paths to the burner-tip, where it impinges on an obstruction and is forced through a small aperture which causes it to break up into a more or less fine spray; and (2) the system in which the oil is atomised by a stream of air or steam.

On board ship, where water supply is limited, the pressure system is adopted, and for land work, where steam would have to be brought from afar, or where the furnace to be heated is intended for purposes other than steam-raising, the pressure-system would perhaps be the more economical; but for boiler work on land the steam atomiser is by far the easier to handle, the less costly to install, the more efficient from the point of view of smoke-abatement, and certainly not the less efficient thermally.

The installation of the pressure system is very complicated, as it requires a multiplicity of accessories such as filter-chambers, heating chambers, etc., all in duplicate, numerous valves, pipes, and by-passes. The minute orifices in the burner-tip get choked and carbonised, requiring frequent changing, with consequent loss of furnace heat, and the oil used must be of high grade.

In the steam-atomised burner the installation is very simple; any grade of oil can be used, and there are no minute orifices to get choked. But, here, again, there seems to be such a plethora of various "patents" that one perforce has to pause.

There are two kinds of steam-atomisers. In one a stream of oil and a jet of steam meet outside the burner, and the steam, issuing with greater force, carries the oil with it; but to enable the oil to be broken up into a fine spray, a striking-bridge has to be provided inside the furnace against which the mixed stream of oil and steam impinges. These are called "outside mixers" and are more or less efficient according to design, but in atomising consume sometimes as much as 5 to 8 per cent. of the total steam raised.



Burner and Connexions.—Type of "Inside mixer."

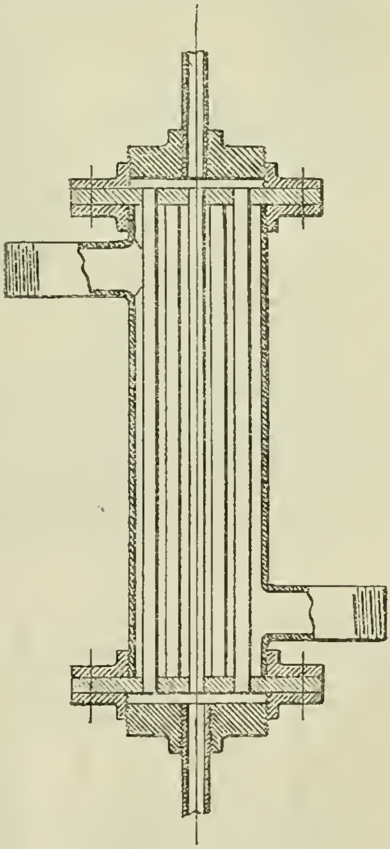
The best-designed burner, in the writer's opinion, is the so-called "inside mixer." In this atomiser the oil is delivered to the burner under pressure. The steam is split up into two channels; one conveys the steam into a small chamber, where it actually mixes with the oil and issues from the burner already mixed; the other channel conveys the remaining portion of steam through a slot beneath the mixing chamber, and on issuing from the burner acts as a guide to the mixture of oil and steam. This burner gives a fish-tail flame, like a gas-burner, and burns comparatively noiselessly. In tests over lengthy periods (not a two- or three-hourly test under favourable conditions) the writer has obtained in actual practice thermal efficiencies varying from 79 to 84 per cent., and a steam-consumption for atomising purposes varying, according to load, from 3·0 to 1·9 per cent.

For efficient combustion of liquid fuel sufficient air is, of course, necessary, but one often meets with an insatiable desire to burn liquid fuel absolutely smokelessly. This is a mistake; it is only achieved by using an excess of air. As it is difficult to gauge when just enough air is being used for complete combustion, it is safer to go just short of perfection and allow a haze of smoke to issue from the chimney than to risk an excessive supply of air, with its attendant cooling, unequal distribution of heat in the combustion chamber, and oxidation of boiler plates and burning out of tubes. The writer has a rough and ready formula for calculating the quantity of air required for complete combustion, viz., by dividing the calorific value of the fuel in B.Th.U. by 100, thus:—

Coal, having a calorific value of 14,000 B.Th.U., would require 14,000/100=140 cb. ft. of air per lb. of fuel.

Oil, with a calorific value of 19,000 B.Th.U., would require 19,000/100=190 cb. ft. of air per lb. of fuel.

These quantities do not fall far short of theoretical requirements and are as nearly as possible actual requirements in practice.

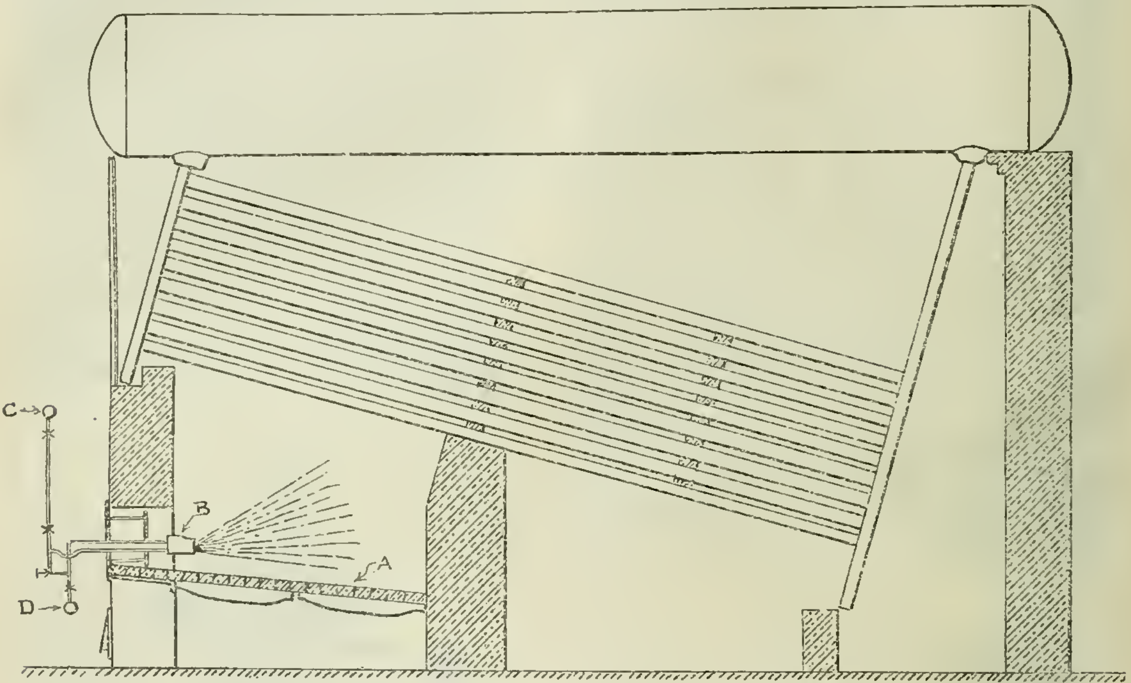


Home-made Oil-heater.
Scale 1½ inches to 1 foot.

Various text-books and system catalogues show illustrations and describe the necessary firebrick linings and chequer walls in flues of boilers; the writer has never found them either necessary or even mildly useful.

In a Lancashire boiler (except for the striking-bridge required by some atomisers) no firebrick liners are used by the writer, and in the refinery at Thames Haven boilers are at work night and day for six months at a period. After all, the less obstruction there is in the flue the easier does the heat reach the boiler-plate, and the quicker is it conveyed to the water on the other side of the plate.

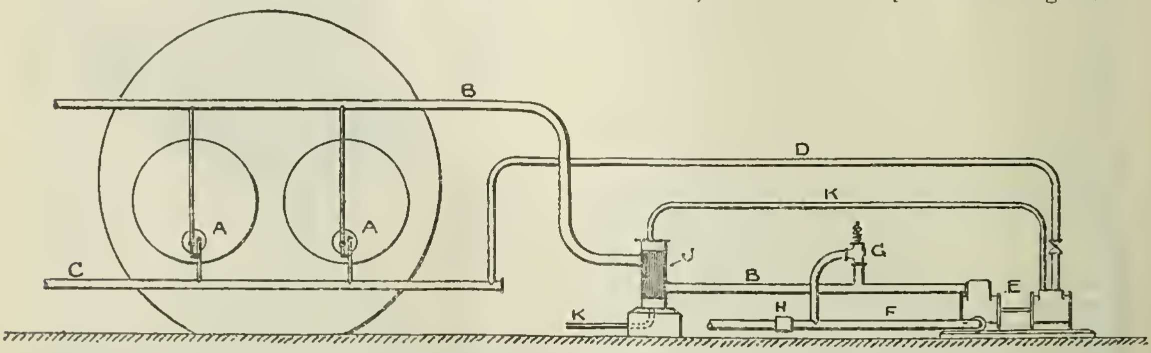
The Lancashire boiler is converted to oil by taking out the fire-bars, replacing the fire-door by a circular plate through which the burner is inserted, and by providing in the front plate a hinged damper (like an ash-pit damper). A circular cast-iron plate some 3 to 4 in. inside the front plate, or a firebrick wall with chequered bricks (to admit air) is also advisable, as it keeps the flame from buckling the front plate and slightly preheats the air required for combustion. The burner itself, with its injector-action, draws in nearly all the air required. The conversion from coal to oil or *vice versâ* can thus be effected in one hour at a cost of a few shillings, once the installation is fitted.



Conversion of a Babcock & Wilcox Boiler to Oil Fuel without alteration of Brickwork.
A.—Firebricks laid on the Firebars. B.—Burner. C.—Oil Supply. D.—Steam Supply.

In a water-tube boiler of the Babcock and Wilcox type the bars can be left in and covered with firebricks laid flat and dry, *i.e.*, no fireclay is used. The furnace-door is replaced by a plate through which the burner can be inserted, a firebrick wall being built up inside the outer front plate with sight- and burner-holes left open. Air is admitted through the burner-opening and by the ash-pit dampers. The air coming up between the loose bricks lifts the flame off the floor, and high efficiency is obtained.

The "System" itself consists of two small duplex pumps (one as a standby) which suck the oil from the tank and deliver it to the burner. In the suction pipe is inserted a gauze filter in duplicate, and in the delivery pipe a small tubular heater. This is heated by the exhaust-steam from the pump. The pump is also provided with a relief-valve which keeps the charge-line at any desired constant pressure. In the steam-delivery to the burner it is well to provide a valve to enable the oil-ducts to be blown-through with steam before being temporarily shut down, or to clear off any oil which might car-



General Arrangement of Installation.
A.—Burners. B.—Oil Supply Pipe. C.—Steam Supply Pipe. D.—Steam Pipe to Pump. E.—Oil Pump. F.—Oil Suction Pipe from Tank. G.—Relief Valve. H.—Oil Filter. J.—Exhaust Steam Heater for Oil. K.—Exhaust Steam Pipe.

bonise on the burner tip. It is also wise to provide settling tanks if the oil contains moisture.

To start the boiler from cold, where steam from another boiler is not available, compressed air would be required both to drive the pump and to act as atomiser. This can, of course, be obtained from a small power-driven air-pump or from a storage-cylinder.

When selecting a "System" do not be trapped by claims of "making something out of nothing." Select the simplest. The only desideratum in design should be to develop every heat unit in the fuel and to convey that heat to the boiler with the minimum of loss and without damage to the boiler.

With reference to the oil, it is well to remember that it should (1) have a flash-point (closed test) not less than 150° F., (2) be sufficiently fluid to be pumped at all temperatures (the specific gravity is not always an indicator of viscosity), (3) not contain more than 1 per cent. of moisture, and (4) be free from solid particles of carbon or other extraneous matter which would unduly choke the filter.

Other points of a more general character are:—The boiler-house should be kept clean. There should be no leaks in the oil-pipes of the system. Trays and save-alls should be provided under the pumps and strainers. No oil should be allowed to lie on the floor. Lighted torches should be extinguished before they are thrown on the floor. A water-hose and a sand-box should be provided in each boiler-room. Finally, it must always be remembered that oil heated to or above its flash-point gives off inflammable vapour precisely as petrol does at ordinary temperatures.

SOCIETY OF CHEMICAL INDUSTRY.

JUNE MEETING OF COUNCIL.

Owing to the difficulties of railway travelling no meeting was held in May, matters of urgency being dealt with by a special committee appointed for the purpose.

The Council meeting was held on June 3, Sir William J. Pope presiding.

In view of the impending Annual Meeting in Canada the Council had requested the Canadian Sections to suggest one of their members for nomination to the office of president for 1921–22. The Sections proposed Prof. R. F. Ruttan, Director of the Chemistry Department, McGill University, Montreal, and the Council nominated him for election at the Annual General Meeting.

Four vice-presidents retire from office this year (*cf.* J., 1921, 144 R). The retiring president, Sir William J. Pope, becomes a vice-president, and the Council nominated Mr. J. L. Baker, Mr. C. S. Garland, and Mr. Max Muspratt to the three remaining vacancies. Mr. W. J. U. Woolcock was elected an ordinary member of Council, in place of Mr. W. J. A. Butterfield resigned, for the period ending with the close of the Annual Meeting, 1921; he is, however, eligible for re-election at that meeting. Mr. E. V. Evans was reappointed hon. treasurer, and Prof. H. Louis hon. foreign secretary. It was intimated that June 15 is the last day for receiving nominations of ordinary members of Council.

The balance-sheet and statement of expenditure and income for 1920 were submitted, together with the certificate of the auditors, and these will be published in the issue of the Journal for June 30. Advance copies of the programme of the meetings of the Society to be held in Canada and the United States were laid on the table; copies will be sent to members as soon as a sufficient supply has been received.

It was decided to hold the Annual Dinner of the Society in London early in October; the date and place will be announced as soon as possible.

Forty new members have been elected since the April meeting of Council. The next meeting will be held on Friday, July 15.

ANNUAL MEETING, 1921.

NICKEL PRODUCTION IN CANADA.

During the past three years, despite the many difficulties arising from the abnormal conditions due to the war and its aftermath, a large and important mining and metallurgical enterprise, complete in every detail, has been developed in Canada. The British America Nickel Corporation (through whose courtesy the following information has been made available) has designed and erected mine and smelter plants near Sudbury, Ontario, and a refinery near Ottawa.

The mines owned by the company occupy over 12,000 acres in the mineral-bearing zone, their present activities being confined to the Murray Mine, which so far discloses 16 million tons of ore averaging from 3 to 4 per cent. nickel and copper, sufficient to keep the plants running for 30 years; but the ore body undoubtedly extends much beyond the present operations. In addition to nickel and copper the ore also carries small but valuable amounts of the metals of the platinum group.

The mine plant is thoroughly up-to-date and is furnished with an ample supply of electric power. In the smelter building there are two large blast furnaces in operation with a third in reserve, each having a capacity of over 800 tons of ore per day. The ore, averaging 24 per cent. silica, 35 per cent. iron, 6 per cent. alumina, 3·7 per cent. lime, 4·3 per cent. magnesia, and 19 per cent. sulphur, is smelted without any preliminary roasting. The flux, being converter slag, contains 16 per cent. silica, 52 per cent. iron, 3·5 per cent. lime, and 3·5 per cent. alumina. The charge consists of 70 to 75 per cent. ore, the balance being flux; 10·5 per cent. coke is used with the charge. The resulting slag contains from 0·24 to 0·34 per cent. nickel, iron and copper, together. The low-grade matte, containing about 12 per cent. nickel and copper, is blown in a converter, and the metal content raised to 80 per cent.; the product is then transferred to an oil-fired furnace, in running from which, through a strong stream of water, it is granulated, and in this condition is shipped to the refinery.

At the refinery the matte passes through two Wedge roasters, each with 8 hearths. This is followed by leaching with sulphuric acid which dissolves the copper in part, the metal being recovered by plating out in electrolytic tanks. The cathodes are melted down and cast into ingots weighing about 80 lb., about 55 tons of copper being produced per 100 tons of nickel.

The leached matte is then smelted with fluxes in specially designed electric furnaces. Circular carbon electrodes are used and the nickel copper anodes are cast in steel moulds. The anodes then go to the nickel-depositing building, which covers three acres, where most of the nickel is plated out and a large amount of nickel sulphate and nickel-ammonium salts is produced for the nickel-plating industries. The precious metals are contained in the slimes from the dissolved nickel anodes; they are collected, concentrated, and refined in another department, yielding platinum, palladium, iridium, rhodium, and some gold and silver. Economical power, to an almost unlimited extent, is available from the development at the Chaudière Falls.

Members attending the annual meeting will doubtless be interested in visiting this metallurgical plant, which is probably the largest of its kind in the world.

CHEMICAL ENGINEERING GROUP.

The second annual meeting was held in London on May 31, Mr. J. Arthur Reavell, chairman, presiding. The hon. treasurer's report called attention to the necessity for increasing the revenue, as during the past year expenditure had exceeded income by £163, or £13 allowing for the sum of £150 set aside to cover the cost of printing the *Proceedings* for 1920. On the credit side, subscriptions amounted to £449 (from 427 members), donations to £327, the grant from the Society to £150; and the main items of expenditure were printing and stationery £507, clerical assistance £343, special and miscellaneous expenses £161. On the motion of Mr. W. Macnab it was agreed to make a levy of 7s. 6d. per member to clear off the deficit. Mr. H. Talbot, in his report, reviewed the activities of the Group during 1920, special reference being made to the success of the conferences held in Birmingham and Newcastle. The Group had done useful work on sub-committees of the British Engineering Standards Association, had co-operated with the Association of British Chemical Manufacturers, and had assisted in opposing the Civil Engineers' (Registration) Bill, which might have adversely affected the position of chemical engineers. Good progress was being made with the compilation and publication of data sheets.

The chairman, hon. secretary, and hon. treasurer were re-appointed, and the following were elected to fill the four vacancies on the committee:—Messrs. W. Macnab, P. Parrish, H. J. Pooley, S. G. M. Ure.

At the annual dinner which followed, Mr. J. Arthur Reavell gave an address on the future of chemical engineering. The present condition of chemical engineering, he said, was less promising than it was a year ago. The very difficult conditions of to-day render it almost impossible for plant manufacturers to make promises regarding delivery, or to put forward with any degree of confidence proposals for new schemes to be undertaken by users. Further, there was very fierce competition from abroad, and buyers were already turning to Germany and to America for plant which they had bought in this country during the war; differences in the rates of exchange were helping our competitors and damaging us.

The answer to the question: What is the position of our chemical engineering industry under such depressing conditions? was that a Britisher was never more dangerous than when everything seemed perfectly hopeless. As we were getting into that position to-day, our future was not so black as it appeared; with the obstinacy and tenacity of our race we should even now be able to put up a fight for the world's trade that would surprise everyone. The future of our industry was closely bound up with the question of the treatment of "key" industries. The Government must decide once and for all whether it is going to protect such industries, or whether it is going to leave our manufacturers and traders to take care of themselves. Meantime, this uncertainty was holding up business. Personally he thought that unless the nations agreed to general disarmament, certain of our resources, which eventually must be used for our own protection in time of war, would have to be protected during times of peace.

The most serious menace to future progress was the unsettled condition of labour. He was convinced from his own observations that the average workman, realising what the extreme labour policy was leading to, was anxious to return to more normal conditions, and this spirit must be encouraged. Until conditions were stabilised, and capital interested, nothing of moment could be accomplished. It was important that men and groups of men who finance large schemes should co-operate with manufacturers of plant to their mutual profit. The financier, like the manufacturer, looked for the best market for his goods, and it must be a great temptation for him, with the present rate of exchange, to take advantage of foreign purchases. This, however, was no help to either party if in the end the whole country was the poorer because of it. That was one of the most important points that affect the future of our chemical industry. Another important point was ability to put products and plant at competitive prices on the world markets; and in order to minimise cost, there had been of late a rush for standardisation. Standardisation had many great advantages, but it should not be overestimated. The success of British engineers and chemists had been due to their individuality, so that if the best was to obtained, industrial effort must not be cramped by carrying it too far. If standardisation were largely confined to parts that are in common use, it would be of help in the future of the industry. Efficiency must be encouraged in every direction; rule-of-thumb working must disappear, and properly trained technical staffs must be available to cope with the ever-changing problems that arise. The future of chemical engineering was bound up with the future of the chemist. The duty of chemical engineers was to put into practice the results of the research and the experiments of the chemist, so that originality of thought and research on the right lines were indispensable to success. Every chemical engineer in this country should rally round the Chemical Engineering Group, so as to make it a huge success. The difficulties with which all young people had to contend were being successfully overcome, and with a better mutual understanding and closer co-operation with the parent Society, the future of the Group and of chemical engineering in this country was assured.

NEWS FROM THE SECTIONS.

MONTREAL.

The annual meeting and dinner were held at the Queen's Hotel, Montreal, on April 22. Mr. C. R. Hazen, chairman of the Section presided, and referred to the regretted death of Dr. Henri St. Georges. The hon. secretary, Mr. G. D. McIntyre, stated in his report that the average attendance at the meetings of the past session had been 55 to 60, and that although a number of members had been transferred to the roll of the new Section at Shawinigan Falls, there was considerable room for improvement in this respect. Four new members and 27 associates had joined the Section during the session. The new draft Rules were submitted and referred to a special sub-committee. On the report of the nominating committee the following officers were elected:—Chairman, Mr. W. H. Matheson (vice-president of Canadian Electro-Products, Ltd., and of Shawinigan Laboratories, Ltd.); hon. treasurer, Mr. T. W. Horner; hon. sec., Mr. J. M. Dickson. The ballot for the election of ordinary members of the committee resulted in the appointment of Messrs. J. B. Bell, R. M. Maclean, G. D. McIntyre, H. J. Roast, and W. B. Woodland; the retiring chairman, Mr. G. R. Hazen, also becomes a member of committee.

BRISTOL AND SOUTH WALES.

The report of the hon. secretary states that the membership of the Section is now about 225. Six meetings were held in Bristol, the average attendance being 40, five in Cardiff and one in Swansea. Mr. C. J. Waterfall was elected chairman, in succession to Mr. Walls, and Mr. A. Marsden succeeds Dr. F. W. Rixon as hon. secretary.

MEETINGS OF OTHER SOCIETIES.

THE FARADAY SOCIETY.

The soil is such a complex mixture of inorganic and organic materials, and is the seat of so many and varied processes—physical, chemical and biological—that the phenomena exhibited by it require for their investigation the co-operation of the physicist, the chemist and the biologist as well as the active support of the agriculturist. It was therefore a very happy idea of the Council of the Faraday Society to organise a general discussion on "Physico-chemical Problems relating to the Soil" and to invite the presence of members of the Agricultural Education Association, the Ecological Society, the Association of Economic Biologists, and other allied societies. The discussion was held on May 31 at Burlington House, with Sir Daniel Hall in the chair. No less than six of the papers communicated were by past or present members of the Rothamsted staff. The discussion was not, however, confined to British workers; two papers were sent by prominent American investigators, and a special feature of the meeting was the presence and active participation of Prof. Sven Odén, of the College of Technology, Stockholm.

Sir Daniel Hall, in his opening remarks, referred to the big change which had taken place in the viewpoint of soil investigation through the modern development of the colloidal hypothesis.

The discussion was opened by Dr. E. J. Russell, who gave, in a general introduction, an explanation of modern views on the constitution of the soil. The mineral particles that make up the framework of the soil are regarded as being coated with a jelly-like colloidal layer of both inorganic and organic material, which has a far-reaching effect on the properties of the soil. The inorganic colloid contained in the clay fraction and the organic colloid both have a large share in contributing to these effects, whilst the effect of calcium carbonate on the state of the clay also has an important influence on soil texture. The soil solution was next dealt with, stress being laid on the disparity between the plant's needs for water and for nutrient salts, so that the very low concentration of the soil solution (*e.g.*, about 0·002% for nitrates) does not necessarily connote any shortage of nutrient material for the growing plant. The absorptive power of the soil colloids and its influence on the composition of the soil solution and on other special phenomeona such as soil "acidity," pan formation, were also considered.

The subsequent papers were divided into four groups. The first of these, dealing with the soil moisture, was opened by Mr. B. A. Keen, of Rothamsted, with a paper on "The System: Soil—Soil Moisture." Work on this subject was critically reviewed, and the various divisions into which soil moisture have been classified were discussed in the light of modern views on the constitution of the soil. The *rôle* of soil colloids in bringing about a progressive gradation in the states of soil moisture, in contrast to the clear-cut divisions formerly imagined, was explained, the various coefficients such as "moisture coefficient," "wilting coefficient," being regarded as equilibrium points between the different states. Recent American work on the osmotic concentration of the soil solution was considered in this connexion. Prof. Odén then read a short "Note on the Hygroscopicity of Clay and the Quantity of Water adsorbed per Unit-Surface," dealing with an interesting application of his new method of mechanical analysis to the determination of the amount of water adsorbed by clay per unit-surface. This application brings out differences due to chemical nature and degree of dispersion, whereas the older Mitscherlich method of calculating the surface of the particles from the hygroscopicity took no account of such differences. Two other papers were communicated in this group, by Prof. D. R. Hoagland, of the University of California, on "The Soil Solution in Relation to the Plant," and by Dr. C. A. Shull, of the University of Kentucky, on "Osmotic Phenomena." In the absence of the authors, *résumés* of their papers were read. The first paper dealt with modern work on the reaction and composition of the soil solution, as they affect, and are affected by, the plant. The second paper discussed the osmotic phenomena concerned in the passage of water from the soil into and through the plant. The nature of semi-permeability in general and of plant membranes in particular was considered; Free's theory of protoplasmic permeability and Loeb's suggestion of electric endosmose were specially noted.

The second group of papers dealt with the organic constituents of the soil. The first paper was by Mr. H. J. Page, of Rothamsted, on "The Part played by Organic Matter in the Soil System." After a critical review of the present state of knowledge of the nature and properties of the humic material in the soil, with special reference to humic acid and to colloidal phenomena, the effect of the humic matter on the properties of the soil was considered under the headings of soil texture, soil moisture, soil temperature, and reaction and composition of the soil solution, and it was shown how the known beneficial effects of organic matter on soil fertility can be largely explained in terms of the colloidal properties of the humic matter in the soil. Prof. Odén then read a paper on "The Application of Physico-chemical Methods to the Study of Humus," dealing specially with his own work on the truly acid nature of humic acid, after which Dr. E. J. Salisbury, of University College, London, brought forward the ecological side of the question in a paper entitled "The Vertical Distribution of Soil Acidity in Natural Soils, and its Relation to Organic Constituents." The different factors influencing the variation of hydrogen-ion concentration with depth in natural soils were considered, with special reference to Cornish woodland soils, and in relation to the degree of humification at different depths; the bearing of these results on the distribution of deep- and shallow-rooted plants was discussed.

The third group of papers dealt with adsorption phenomena. Mr. E. A. Fisher, of the University of Leeds, contributed a paper on "The Phenomena of Absorption in Soils: A Critical Discussion of the Hypotheses put forward." The author made a powerful plea for the more general recognition of the fact that the applicability of an empirical equation such as that of Freundlich to a soil reaction is no criterion of the occurrence of a true adsorption, since such an equation also applies to many reactions which are not adsorptions, and he advanced arguments to show that many of the facts of adsorption by soil are described equally well, and explained more satisfactorily by purely chemical theories developed from that originally advanced by Way. Mr. E. M. Crowther, of Rothamsted, followed with a paper on "Soil Acidity in its Physico-chemical Aspects," in which he dealt with the methods of measuring the so-called "lime-requirement" and the hydrogen-ion concentration of soils; the action of neutral salts on acid soils and the relation of soil acidity to plant growth were further considered. Owing to shortage of time, Mr. C. G. T. Morison did not read his paper on "Pan Formation."

The final group of papers dealt with colloidal phenomena. Prof. Odén opened with a paper on "Clays as Disperse Systems," describing his new method of mechanical analysis and its application to the examination of certain Swedish clay deposits. Mr. N. M. Comber, of the University of Leeds, followed with a paper on "The Mechanism of Flocculation of Soils," in which he attributed the abnormal flocculation phenomena exhibited by clay in the presence of alkalis to the conferring on the clay of "emulsoid" properties by a coating of colloidal silicic acid around the clay particles, thus affording a satisfactory explanation of what has hitherto been a puzzling anomaly in the behaviour of clay compared with the other soil fractions. Mr. J. W. Robinson, of the University College of N. Wales, Bangor, then read a paper on "The Physical Properties of the Soil in relation to Survey Work," in which he pointed out the need for simple reliable methods of measuring the physical properties of soils as a means of defining their inherent capabilities, since the ordinary methods of mechanical analysis are often useless except for purposes of genetic classification. Dr. J. W. Mellor's paper on "The Plasticity of Clay" was taken as read in the absence of the author.

Although the time consumed by authors in presenting their papers was, perhaps, unduly long in comparison with the time available for discussion, the Faraday Society is, nevertheless, to be heartily congratulated on the success of the meeting.

On June 1 a delightful day was spent at Rothamsted, where Dr. Russell and his staff spared no trouble to acquaint the visitors with the numerous investigations that are being carried out. The morning was spent in the laboratories and the afternoon in the fields. Of great interest were the experimental plots put down to wheat and barley to test the relative fertilising efficiency of sulphate and chloride of ammonia.

SOCIETY OF GLASS TECHNOLOGY.

The May meeting of the Society was held in the University, Sheffield, on May 18, the president, Dr. M. W. Travers, in the chair. The first paper was entitled "The Shrinkage, Porosity and Density of British Fireclays after Firing at 1500° C.," by Edith M. Firth and W. E. S. Turner. Prof. Turner explained that the paper represented a continuation of the work on certain physical properties of British clays which had been described a year ago at Sheffield. The results now presented related to the shrinkage, porosity, and density of the same set of clays between 1400° and 1500° C. In this temperature-range, eight of the clays showed a negative shrinkage (expansion), and two only exhibited a distinct increase in porosity, the rest showing either a small increase or a large diminution. Increased porosity was undesirable, as it was usually a sign of blistering, due to "over-firing." Of the seven clays which showed blistering, five showed the phenomenon only on the surface. Thus 25 out of the 27 clays investigated were usable at 1400°—1500° C., although those which expanded at this temperature would preferably be avoided.

The second paper was by Mr. J. R. Clarke on "The Effect of the Rays of Radium, X-rays, and Ultra-violet Rays on Glass." Seven lime-soda glasses, three of which contained selenium and three cobalt, were exposed to the action of the $\alpha+\beta+\gamma$ rays, $\beta+\gamma$ rays, γ rays, X-rays and ultra-violet rays. The first six were coloured brown by the β rays; the intensity of coloration was greatest on the surface and increased with increasing selenium and cobalt content. As the radiation was prolonged, the intensity increased to a maximum, depending on the percentage of colouring agent, and then remained constant. The seventh glass—pure lime-soda—was only affected by the α rays. None of the glasses was coloured by γ rays, X-rays, or ultra-violet rays with the exposures given. All the glasses fluoresced when kept in radium emanation, but a "fatigue" effect was observed at about the same time as the maximum intensity of coloration was reached. It is thought that the α rays are the chief agents in producing fluorescence, though the β rays are also effective. The colouring is concluded to be due to the formation of colloidal particles in the glasses, and it is suggested that the presence of such particles may be explained by the action of the α or β rays on dissociated ions already present in the glasses.

SOCIETY OF PUBLIC ANALYSTS.

Five papers were read at the meeting held in the Chemical Society's Rooms on June 1, Mr. A. Smetham presiding. In the first paper, on "The Composition of Egg Powder," Messrs. F. F. Beach, T. E. Needs, and E. Russell recorded the results of examining so-called egg powders, comparing them with ordinary baking powders. A table of compositions was given, and it was suggested that a standard based on certain specified figures might be laid down for a minimum percentage of actual egg in such preparations. Mr. N. Evers described the colorimetric method of determining hydrogen-ion concentration by means of indicators, and gave examples of its utility in replacing titration methods in the determination of the "acidity" or "alkalinity" of various products, and of the purity of certain fine chemicals. Mr. F. R. Dodd, in a paper on "The Estimation of Woody Fibre in Cattle Foods," referred to the discrepancies between the results obtained by different analysts working on the same sample by varying processes and suggested a modification of the method to obviate them. The identification of certain fixed oils by the spectrometer was dealt with by Mr. H. C. T. Gardner, who exhibited absorption spectra of a number of vegetable oils and discussed the possibility of identifying such oils by means of absorption spectra. Spectroscopic examination is not sufficient for identification, but evidence of identity can be obtained in certain cases by measuring the positions of the termination of visibility and the extent of visibility of absorption spectra. In the final paper, Mr. J. L. Lizius described the joint use of two indicators in the titration of acids and bases.

THE PHYSICAL SOCIETY.

At the meeting held on May 27, Dr. N. R. Campbell read a paper on "A Method of Micro-analysis of Gases, by the Use of the Pirani Gauge." A well-known equation of the form $\log p = A - \frac{B}{T-T_0}$ expresses the relation between the vapour pressure p of any substance and the temperature T. It can be readily deduced that the value of $\frac{1}{p}\frac{d}{dt}$ becomes infinite as the vapour pressure approaches zero at the temperature T_0, a temperature characteristic of the vapour and called the condensation temperature. If, then, a vapour-pressure-temperature curve be determined for a mixture of condensable gases or vapours, abrupt changes of inclination of this curve are found to occur at temperatures corresponding to the respective condensation temperatures of the constituents of the mixture. These temperatures determine the constituents qualitatively, and the magnitudes of the several abrupt increments of pressure serve to determine the composition of the mixture quantitatively. Mixtures containing minute traces of various gases can be analysed by the method, and to this end a suitable type of pressure gauge has been designed by Pirani consisting of a fine, heated wire immersed in the gas at very low pressure—

of the order of 0·01 mm. of mercury. This wire forms one arm of a Wheatstone network, and the three remaining arms are constituted of manganin resistances. It is found that the electrical energy necessary to maintain the heated wire at a definite excess temperature above its surroundings is a function of the pressure of the gas surrounding the wire. The procedure is therefore as follows: the gauge is connected with a side-tube and the gas therein cooled by immersing this tube in various cooling media, most readily obtained by freezing various substances with liquid air. Thus in analysing a mixture containing phosphorus vapour, water, an unidentified vapour from "vacuum" oil, carbon dioxide, hydrogen, and carbon monoxide, the cooling agents employed are freezing mercury (−39° C.), freezing acetone (−95° C.), freezing ethyl alcohol (−117° C.), liquid air (−183° C.). The side-tube is immersed in each of these baths in turn and the gas pressure determined as above. The various constituents of the mixture are thus readily ascertained both qualitatively and quantitatively. The method is capable of wide application, and it may be applied to the quantitative determination of the several higher unsaturated hydrocarbons present in coal gas.

A paper on "The Intensity of X-ray Reflection by Diamond" was read by Sir W. H. Bragg.

ROYAL SOCIETY OF ARTS.

On May 30 Sir Kenneth Goadby read a paper on "Immunity and Industrial Disease," the Rt. Hon. J. R. Clynes presiding.

The author classified industrial disease under two main types:—(*a*) Primary, due to a specific material handled in the occupation, and (*b*) secondary, non-specific to industry but to which the occupation may predispose. Although the determining factors of most occupational diseases are known, the factor of individual immunity and susceptibility has been neglected. The primary industrial diseases in which immunity and susceptibility play an important part are those due to bacterial infections, diseases caused by actual contact of the hands or body with poisonous material (*e.g.*, TNT, atropine, mercury), and diseases due to dust, fumes, and vapours (*e.g.*, lead, arsenic, paint, dope, etc.). Of the secondary diseases it may be said that they seldom arise from the same causes as those which produce the primary diseases (*e.g.*, tuberculosis among potters is not a consequence of lead poisoning, but of the inhalation of dust particles). Dust, fumes and vapour are responsible for a large proportion of industrial diseases, and individual susceptibility is undoubtedly a significant factor in lead poisoning. The ordinary routine medical examination is of no value for detecting susceptibility owing to the gradual tolerance which is developed by the majority of persons exposed to lead absorption, and which usually occurs within the first three months of exposure. The high incidence of poisoning in the painting trades as compared with white-lead manufacture is difficult to understand, but in many cases it is due to turpentine. The fact that arteriosclerosis (premature degeneration of the blood vessels) with an increase of blood pressure is far more common among painters than among white-lead workers is due to the vehicle in which the paint is used, *i.e.*, mainly to turpentine and its substitutes.

Modern research has shown that the white blood cells are the chief destroyers of living germs and poisons, and that diminished resistance to poisons is accompanied by a decrease in their number. In his researches on the composition of the blood in industrial and other diseases, the author has found that in all chronic infections an alteration in the proportion of white cells may be detected (mainly a decrease in the chief phagocytes), which usually occurs before the outward signs of ill-health are apparent; and that diminution in white blood cells is accompanied by diminished resistance to such poisons as lead, mercury and paint; such persons are particularly susceptible to lead poisoning, etc. He therefore recommends that blood tests (blood pressure and blood counts) be made on persons entering such occupations, so that by eliminating the unfit the incidence of industrial poisoning would be reduced, and some occupations now regarded as dangerous might even be rendered safe. In the painting trade two examinations, one after three and one after six months' employment, would suffice to eliminate susceptible workers. In concluding, the author urged that trade unions should initiate special health committees, not for providing medicine for the sick, but for conserving their capital—health; and in this he was heartily supported by the chairman.

THE CERAMIC SOCIETY.

The Refractory Materials Section of the Ceramic Society held a meeting in Paris on May 11, conjointly with the corresponding French society. Four papers were communicated, the first being a report of "Resistance Tests on Refractory Products under Lead at Different Temperatures," by Capt. V. Bodin. The author has experimented with a Frémont machine modified for testing metals, using a special spiral-flame furnace, and a recording apparatus fitted to the machine. The curves thus obtained enabled the crushing load to be determined. The deductions drawn by the author are:—(1) Most refractory products, especially those composed essentially of silica and alumina or silica alone, tend to show a decreased resistance to load on heating, the minimum being generally about 800° C. (2) The same products when further heated show rapidly increasing resistance, with a maximum usually at about 1000° C. For certain clays this maximum may be four times the minimum, or even more. (3) Still further rise in temperature causes a gradual diminution in the resistance, tending towards zero at about 1600° C. with all refractory products. (4) In general, all refractory products tend to become plastic or semi-plastic at about 1200° C. or higher. The minimum is very important practically, as the whole of the refractory masonry of a furnace passes through the critical range of temperature corresponding to minimum resistance, both during the heating and the cooling; trouble may then arise which has hitherto not been explicable.

It is suggested that, though the fusing temperature of a refractory brick cannot be varied by modifying size of grog, compactness, etc., the minimum resistance may probably be raised by this means and the quality of the brick thus improved. The author concludes that the refractory properties of bauxite are improved by raising the firing temperature, as Le Chatelier found with clay. The maximum has not the same practical importance as the minimum, but if refractory materials could be chosen so that their working temperatures were exactly those of maximum resistances (which are not the same for all products), the working conditions would be very favourable to durability.

The second paper was a preliminary note on "Dinas Bricks of Constant Volume," by Prof. O. Rebuffat. The author found that the specific gravity of Lagonegro quartzite is reduced from 2·65 to 2·25 after calcining for eight hours at about 1300—1350° C. He also found that this quartzite contains 0·31 per cent. phosphoric anhydride. On removing the phosphoric anhydride with concentrated nitric acid and calcining the purified rock for eight hours at 1300—1350° C., the sp. gr. was found to be 2·6. The author also impregnated a very pure primary quartzite of sp. gr. 2·60 (unchanged even after heating for eight hours at 1300—1350° C.) with 3 per cent. of an alkali-glass containing 16 per cent. phosphoric anhydride, and heated the mixture for eight hours at 1300—1350° C. The product had a sp. gr. of 2·27—2·30, and closely resembled the fired Lagonegro quartzite. Having regard to the wide distribution of phosphoric acid in rocks, the author suggests that quartzites which give bricks of constant volume owe their special properties to the presence of small proportions of phosphoric acid.

The next paper was on "Some Difficulties Experienced in Maintaining a Pyrometer Installation in a Works," by Mr. R. S. Whipple. The author attributes want of success in any pyrometer installation nearly always to (1) the choice of the wrong type of instrument, (2) inefficient use of the instrument, or (3) the instrument itself requiring adjustment or correction. Each of these causes was discussed at length.

The last paper, "Notes on American Practice in Refractories," by Mr. W. J. Rees, was the outcome of the author's visit to the United States last autumn. Mr. Rees observed that the outstanding feature of American practice is the well-developed organisation of plant for production at minimum cost. The elimination of hand-labour is a marked feature of the larger plants, and the use of waste heat in tunnel dryers is also noteworthy. Reference was made to a new machine in which, without the application of pressure, the normal operations of the hand-making process are translated into mechanical operations; the machine is tended by unskilled labourers, and the silica bricks produced from it are equal to the best hand-made bricks. The "Dando" ladle brick, which is used to line large basic-steel ladles, lasts 20 to 30 heats, as compared with 8 to 10 heats for high-grade firebricks. The refractoriness of the raw clays varies between cones 16 and 20, and the maximum firing temperature of the bricks is about cone 4. These bricks are made by a dry-pressing process, and the kilns are down-draught, but with eight short chimneys—one between each two fireholes. There is no preliminary drying of the bricks, so the smoking period lasts about nine days and the burning proper a further six days. The manufacture of silica bricks, etc., was described in detail, and developments connected with magnesite and dolomite refractories were discussed.

THE CHEMICAL SOCIETY.

At the ordinary scientific meeting held on June 2, Dr. M. O. Forster presiding, Dr. Harold King, of the National Institute for Medical Research, gave an account of "Derivatives of Sulphur in Commercial Salvarsan." The chief points of interest were that the main sulphur-containing impurity which separates when salvarsan is dissolved in methyl alcohol is a mixed arseno-derivative which on oxidation gives 3-amino-4-hydroxy-5-sulphophenylarsinic acid and 3 amino-4-hydroxyphenylarsinic acid, and that at an intermediate stage in the manufacture of salvarsan the generator of this substance can be isolated in the form of what is probably the corresponding sulphinic acid. Therapeutic experiments on experimental trypanosomiasis in mice point to the undesirability of the presence of this sulphur derivative in commercial salvarsan.

Summarising a paper on "Physical Chemistry of the Oxides of Lead. Pt. I.: The Solubility of Lead Monoxide," Mr. S. Glasstone described the preparation of red-brown, yellow, and red forms of lead monoxide by the action of caustic alkalis on lead acetate solution. The red form probably consists of finely-divided particles of the red, and the yellow form of agglomerated particles of the red. Determinations of the equilibrium solubility and other data indicated that the differences between these three forms of lead monoxide are due to state of division or agglomeration, and not to enantiotropic changes.

A paper on "Latent Heats of Fusion. Pt. I.: Benzophenone, Phenol, and Sulphur," by K. Stratton and Prof. J. R. Partington, was presented by the latter. A weighed amount of the substance is fused by an electric current passed through a heating coil, the material being surrounded by a bath of partly-fused substance at the melting-point. The following values were found, in gram-calories per gram of substance:—Benzophenone 21·7; sulphur (monoclinic) 8·84; phenol 29·06.

Other papers presented in abstract were:—"Researches on Residual Affinity and Co-ordination. Pt. V. Gallium Acetylacetone and its Analogues": G. T. Morgan and H. D. K. Drew. "Some New Tricyclic Bases": T. S. Moore and I. Doubleday. Prof. K. G. Naik summarised his recent work on dithioketones and dithioethers, and Messrs. C. K. Ingold and W. J. Powell their studies of some abnormal condensations of malonic and cyanoacetic esters with halogenated methanes.

PERSONALIA.

Prof. Lemoine, of the Ecole Polytechnique at Paris, has been elected president of the Académie des Sciences.

Dr. William Wilson has been appointed to the London University chair of physics, tenable at Bedford College.

Dr. G. Rutter, deputy-director of research at the Royal Arsenal, Woolwich, has been appointed director of research in succession to Sir Robert Robertson.

Mr. H. Talbot, hon. secretary of the Chemical Engineering Group of the Society of Chemical Industry, has been appointed general manager of the Welsbach Light Co., Ltd.

Mr. K. C. Browning has been appointed professor of chemistry and metallurgy at the Artillery College (formerly the Royal Ordnance College), Woolwich. Prof. Browning was for fifteen years Government Analyst in Ceylon.

On May 9, at Washington, U.S.A., Dr. F. B. Power was presented with a gold medal, conferred by Mr. Henry S. Wellcome, in recognition of his distinguished services to science during the 18½ years he served as director of the Wellcome Chemical Research Laboratories in London. This honour to Dr. Power will be appreciated by his many friends in this country and not least by members of this Society, to whom his work on the Council, the Publications Committee, and the Committee of the London Section is well known.

To the Advisory Committee of the Board of Trade for the Metalliferous Mining Industry, the Secretary for Mines has appointed:—Prof. H. Louis, Dr. J. M. Maclaren, and Mr. T. C. F. Hall (economic geologists); Mr. F. W. Harbord (metallurgist); Mr. T. Falcon, Dr. F. H. Hatch, and Mr. F. Merricks (mining engineers). Sir C. L. Budd is chairman of the Committee, there are twelve representatives of owners of and workers in the iron, tin, lead and zinc-ore mines. Mr. J. J. Burton represents the iron and steel industry, and Sir K. W. Goadby, medical science.

CORRESPONDENCE.

AMERICAN METHODS OF BACTERIOLOGICAL WATER CONTROL.

Sir,—I wish to direct attention to some of the criticisms contained in the review of Milton Stein's "Water Purification Plants and their Operation," by Mr. D. B. Byles in the issue of April 30.

The bacteriological tests, which are stated to be somewhat crude, are, in principle, those adopted by the American Society of Bacteriologists, the American Public Health Association, the American Chemical Society, and the American Waterworks Association. The methods in general are particularly suitable for the control of water-purification plants which, in America, are controlled from works laboratories which are almost invariably staffed by trained men. Whilst the amount of work done on each sample will not compare with that done by the well-known organisation of which Mr. Byles is a member, it must be remembered that the smaller works cannot afford it and they prefer to make five presumptive tests for *B. coli* rather than one test carried to the confirmatory stage. Almost every city with a population of 100,000 and over has its own waterworks laboratory and the scientific control of the purification processes is usually far superior to that in English works, with the exception of the Metropolitan Water Board.

The comparison between English and American standards is entirely misleading, for it is quite erroneous to presume that the latter is a relative one. The American standards are absolute, fixed by the experts attached to the Treasury, and specify that the sample shall not contain more than a definite number of *B. coli* per 100 c.c. The standard, unlike our own, has a definite legal standing.—I am, Sir, etc.,

Joseph Race.

Hereford.
May 18, 1921.

Sir,—In reply to Mr. Race's letter, I would point out that the important test of bacteriological purity of a water is its intestinal-microbic content, and that my criticism was directed to two points, namely (i) that the tests themselves were inconclusive in that the media employed (lactose-broth and litmus-lactose-agar) would include many microbes of non-intestinal origin, and (ii) that the quantity of filtered water tested, namely 0·1, 1, and 10 c.c. in the fluid medium and three 1 c.c. plates in the litmus-lactose-agar, does not permit of very great accuracy; in fact, on these tests it would be impossible to deduce "a definite number of *B. coli* per 100 c.c.," which Mr. Race says is the American legal standard unless that number were 10 or more.

With regard to "standards," I am afraid I used the term somewhat loosely and should have said "the method of expressing results." Several recent American publications which have come to my notice have expressed results in the manner indicated in my review, and this was in my mind when I wrote the words Mr. Race refers to.

I am in full agreement with Mr. Race that, on the whole, the scientific control of American water-undertakings is superior to our own, but it must not be forgotten that, with few exceptions, the supplies to our large towns are derived from upland gathering grounds far removed from any source of pollution.

As I stated in my review, much of Mr. Stein's book is excellent, and presumably the author himself would welcome a reasonable amount of well-meant criticism.—I am, Sir, etc.,

D. B. Byles.

Metropolitan Water Board, London.
May 24, 1921.

POST-GRADUATE TRAINING IN INDUSTRIAL CHEMISTRY.

Sir,—Mr. Francis H. Carr's paper on the above subject (*cf.* J., 1921, 161 R) comes most opportunely at a time when opinion on this vital question has become dulled by natural relief at relaxation from intensive war effort, by lapse of time from the war period, by the knowledge that money will be required to institute schools such as are outlined, and finally by the serious state of unrest latterly manifested in industry. The need of post-graduate training for those destined to take up the practice of industrial chemistry has been emphasised repeatedly by leaders in science and industry, and if the public could only be brought to realise its importance, the Government might be stirred to action. Now is the time to start this training; tomorrow will be too late.

During the war the Government called on the Universities and Technical Colleges for assistance in the direction and control of scientific warfare in all its phases, and it is well known how well that call was met. The Universities and Technical Colleges now call for aid in founding schools which shall be one safeguard against future unpreparedness. Mr. Carr rightly calls for assistance from the Government, but there is great danger that the swing of the "economy pendulum" will hold back the necessary assistance. Immediate steps, however, could be taken by the Government, without any expenditure of money, and the writer wishes to draw attention to the means available in the hope that some concerted action on the part of those concerned may lead to something being done.

During the war the Government built many national chemical factories for the manufacture of explosives. These were exceedingly well equipped and large stocks of spares were accumulated as necessary to the work in hand. Instead of allowing machinery, plant and stores to lie idle at factories, and I refer particularly to material deliberately acknowledged as surplus Government stock or already advertised for sale, the Government might reasonably place at the disposal of those institutions which have already taken up, or are prepared to take up, training in industrial chemistry such plant and stores as are available. For laboratory equipment there are balances, sample crushers and grinders, electric motors, microscopes, and all kinds of general analytical appliances which would be useful. For technical-scale work there are chemical lead sheeting and piping and all appliances for handling and working same, regulus metal in the form of flanges and valves, lead coils; cast-iron and steel tanks of many varieties and sizes, cast-iron and steel piping, coils and flanges; nuts and bolts, pulley wheels, shafting, belting, agitating gear, steel plates, steel drums, cast-iron and steel valves for all purposes, chemical stoneware tanks, pipes and taps of all varieties, carboys, weighing machines small and large, pyrometers, thermo-couples, indicators and recorders, gauges, acid-ware bricks and tiles, CO_2- and SO_2-recorders, Orsat apparatus sets, centrifugal pumps of cast iron, steel and regulus metal, positive-action rotary pumps, electric motors, tools of every variety, fans and blowers, steel stairways, wood stairways, trucks, trolleys, bucket elevators, band conveyers, portable forges, welding sets, steam boilers, aluminimum ware, and enamelled iron ware.

Naturally, if some of this material were thus made available gratis to the Universities and Technical Colleges the prospective money value would be lost to the Government, and estimates of a possible credit from surplus stores, etc., would have to be adjusted to the extent of a few thousand pounds. However, such credit estimates are only of transient value and it would be well worth while for the country to exchange some of them, at least, for the solid value which the surplus material would acquire when put to such training purposes as outlined by Mr. Carr. Further, the Government has on hand many surplus buildings of wood, uralite, and corrugated iron. Could not some of these be offered as temporary buildings for those institutions which are not already provided with accommodation for technical chemical work?—I am, Sir, etc.,

Edinburgh University. A. Cottrell.
May 25, 1921.

NEWS AND NOTES.

CANADA.

Projected Petroleum Refinery at Fort Norman.—It is reported that a small refinery is to be built near the Fort Norman oilfields on the Mackenzie River, British Columbia (*cf.* J., 1920, 435 R), and that the material for the plant has already arrived. It is intended to produce petrol for the local aeroplane and river-transport services.—(*Oil, Paint and Drug Rep., May* 16, 1921.)

JAPAN.

Reported Discovery of a Phosphate Deposit.—According to the *Japan Times*, the "Rasa Phosphate Ore Co.," of Tokyo, has discovered a phosphate deposit on a hitherto unknown island lying to the south of Rasa Island which is superficially estimated to contain 15 million tons. Development work has already begun and the company is negotiating with the banks for a loan of 7 million yen (about £700,000) to finance operations.—(*Chem. Ind., May* 23, 1921.)

AUSTRALIA.

Osmiridium Production in Tasmania.—Practically the whole of the Australian production of osmiridium is derived from Tasmania, where the output in 1920 amounted to 2000 oz., valued at £77,114, the average price being £38 per ounce. At present there is very little market for the product and the Tasmanian Government is investigating the situation. For some years back large quantities of Tasmanian osmiridium have been used in the natural state in the manufacture of the nibs of fountain pens.—(*Bull. Dept. Tr. and Co., Can., May* 16, 1921.)

SOUTH AFRICA.

Industrial Notes.—Recent mining developments include the exploitation on a large scale of the asbestos deposits in the Kuruman and Barkly West districts by a new company with a capital of £150,000, and the working of certain nickel and talc deposits in the Barberton district (*cf.* J., 1920, 271 R, 304 R) by the South African Nickel and Talc Mines, Ltd. (capital £100,000).

Among other industrial developments are the establishment of oil mills at Congella, Durban, by the African Oil Mills, Ltd., and the exploitation of certain fibres in the Cape Province for the manufacture of paper pulp and of jute substitutes by a Johannesburg syndicate.—(*S. Afr. J. Ind., Mar. Apr., May,* 1921.)

Sugar Production in Natal.—It is estimated that the sugar produced in Natal during the 1920–21 season will not exceed 150,000 tons of manufactured sugar, as compared with 185,000 t. in the preceding season. But for the severe drought with which the season opened and the excessively wet period at its close, the yield would probably have been higher by about 50,000 t.; at Illovo, from 12 to 13 t. of cane was required to make a ton of sugar. The production of sugar in Natal during recent years has been as follows:—1916–17, 114,580 t.; 1917–18, 107,000 t.; 1918–19, 155,000 t.; 1919–20, 185,000 t. Formerly sugar-cane was usually planted on large holdings by the owner of a mill, but the present practice is for small holders to plant the cane and sell it to the mills.—(*U.S.Com. Rep., Apr.* 14, 1921.)

BRITISH INDIA.

The Sesamum Industry.—The final estimate of the sesamum crop for 1920–21 is 368,000 tons over 4,291,000 acres, compared with 449,000 t. and 4,254,000 acres in 1919–20. In addition, sesamum is grown in certain other districts, mainly in Burma, the acreage of which has averaged 1,214,000 and the crop 104,000 t. during the last five years. (*Cf.* J., 1921, 87 R.) Exports to countries overseas have been as follows:—1916–17, 84,181 tons; 1917–18, 16,193 t.; 1918–19, 2384 t.; 1919–20, 49,325 t.; and 1920–21, 11,832 t.—(*Ind. Tr. J., Apr.* 22, 1921.)

Exports of Minerals and Metals in 1920.—The Board of Trade has received the following statistics from the Government of India relating to exports of metals and minerals from India during 1920:—

		Long tons.
Brass, bronze and similar alloys		128·35
Chromite		30,675
Copper		79·95
Ferro-manganese		3,877
Iron, pig		44,368
„ other sorts		1,384
Lead, pig		21,477·75
„ other sorts		12·6
Manganese ore		711,424
Tin		3·3
„ ore		704
Wolfram ore		2,934
Zinc or spelter, all sorts		75
Metals, unenumerated		112·45
Ores		1,096
Mica		3,825·85
Monazite		940
Jade stone		221.8
Coal		1,228,408
Mineral oils, benzine ..	(galls.)	21,240,678
„ other kinds ..	(galls.)	823,214
Salt		827
Gold (uncoined)	(oz.)	909,999
Silver	(oz.)	1,644,315

—(*Board of Trade J., May* 12, 1921.)

UNITED STATES.

Synthetic Resins from Furfural.—Now that cheap methods of making furfural from corn cobs have been perfected, it is probable that synthetic resins will be made from it on a commercial scale. These resins soften between 25° and 100° C., and are insoluble in water but readily soluble in benzene, acetone and alcohol; they impart a glossy surface to materials to which they are applied.

Syrup from Sweet Potatoes.—The Department of Agriculture is erecting a semi-large scale plant for the production of a table syrup from sweet potatoes, which is said to be very satisfactory. Sweet-potato flour has not been a success thus far and new methods for its preparation are under consideration. The boll weevil is responsible for the extension of the cultivation of the sweet potato in localities where cotton is no longer profitable.

Recovery of Waste Products in Beet-sugar Manufacture.—A plant for the recovery of waste products from a beet-sugar factory is to be erected at a cost of $104,000. The amounts of these products to be treated are beet-carrying and wash water 2,000,000 gallons, diffusion-battery and pulp-press water 200,000 galls., lime press-cake containing 50 per cent. water 37 tons, and Steffens' house-wastes 200,000 galls. It is intended to recover potash, to increase the yield of sugar, and to discharge the purified effluent into the river.

Magnesite in 1920.—The total sales, and the approximate production, of crude magnesite in the United States in 1919 amounted to 156,266 short tons. During the early part of the year sales were limited owing to the decreased demand from the steel industry which was expecting the arrival of cheaper European magnesite, but this did not happen and buying was resumed in the summer. A Bill was presented to the House of Representatives in 1919 providing for protective duties on imported magnesite, but this was opposed by manufacturers of refractory products, and the Bill had not been passed by January, 1921. Practically all the magnesite produced by the three companies operating in Washington in 1919 was converted into ferro-magnesite and sold to steel plants or makers of refractories; and most of the output of the 18 producing mines in California was used in the manufacture of oxychloride or Sorel cement (finely-ground calcined magnesite mixed with a solution of magnesium chloride and certain filling materials). The use of magnesite cement for flooring and wall plaster is extending. Imports of magnesite amounted to 15,852 short tons, of which Canada supplied approximately 51, Austria-Hungary 17, Mexico 16, and Italy 16 per cent. (*cf.* J., 1919, 456 R).—(*U.S. Geol. Surv., Mar.* 7, 1921.)

Lithium Minerals in 1919.—According to the United States Geological Survey, the output of lithium minerals in that country was 6287 short tons in 1919, or more than ten times greater than in 1916. South Dakota and California supply practically the entire output and the deposits are ample to supply requirements in the United States for a long time to come, even if unexpected uses should be discovered. The chief lithium minerals are lepidolite, a lithium mica obtained largely from California, spodumene, a lithium-aluminium metasilicate from South Dakota, and amblygonite, a phosphate and fluoride of aluminium and lithium, also from S. Dakota. A lithium mineral is also won in Spain at a single mine in the province of Caceres, which produced only 11 t. in 1918. Much of the lithium minerals produced is manufactured into lithium hydroxide, which is used in a certain type of storage battery, lithium salts and lepidolite are used in glass batches to reduce the viscosity of the glass (U.S.Pat. 1,261,015; J., 1918, 418 A), and the fluorine in the mineral as an opacifying agent for opal glass. Lepidolite might also be used to reduce the viscosity of enamels, but so far as is known it has not been utilised for this purpose. The bromide and iodide have been used in photography and the cyanide in X-ray work; the chloride is used to some extent in pyrotechny; and the carbonate, mixed with carmine, is used as a nuclear stain. Coal-tar products have largely superseded lithium salts in the treatment of rheumatism and allied affections.

Sodium Compounds in the United States in 1920.—The following preliminary figures of production, importation and exportation of sodium compounds in the United States in 1920, compiled by the U.S. Geological Survey, have been supplied by the Department of Overseas Trade (from the *Journal of Commerce, N.Y.*). Sales for the year amounted to 9,886,020 short tons, valued at $139,336,338, which represent an increase of 8 per cent. in quantity and 17 per cent. in value compared with 1919. Considerable decreases took place in the sales of sodium bichromate, ferrocyanide, nitrate, thiosulphate, and sal soda, but there were large increases in sales of bicarbonate, bisulphate, phosphate, borate, and soda ash. Sodium compounds derived from natural sources (excluding common salt) increased to 42,683 t., valued at $1,513,179. Imports of sodium compounds also increased, but only in the case of sodium nitrite did importation exceed production. The exports, chiefly to Japan, Canada, and Mexico, are believed to constitute a record.

Sales of Chief Sodium Compounds, 1919-20.

	Short tons.	
	1919.	1920.
Sodium acetate	778	1,020
Sodium bicarbonate	134,962	188,906
Sodium bichromate	26,526	25,973
Sodium bisulphite	11,819	22.059
Soda ash	981.054	1,242,490
Sal soda	80.090	62,857
Sodium hydroxide	311,388	382,680
Sodium phosphate	14,760	30,515
Sodium silicate	300,138	304,503
Salt cake	134,685	184,946
Glauber's salt	42,087	44,479
Nitre cake	83.402	308.638
Sodium sulphide	45,448	42,952
Sodium tetraborate	28,518	35,281

Imports.

	Short tons.	
	1919.	1920.
Sodium chlorate	262	281
Sodium cyanide	1,208	3,795
Sodium nitrate	1,024,053	1,480,519
Sodium nitrite	4,570	4,845

Exports of Domestic Products.

	Short tons.	
	1919.	1920.
Soda ash	50,481	8,338
Sal soda	5,553	6,015
Caustic soda	82,118	112,069
Sodium silicate	12,150	17,048

Better prices for sodium compounds were obtained in 1920 than in 1919, although they fell off towards the end of the year. Sodium sulphate was in great demand from abroad. Prices of the raw materials used in the manufacture of sodium compounds now appear to have come down almost to pre-war levels.

GENERAL.

British Laboratory Ware.—The question of the quality, supply, and prices of British laboratory glassware, porcelain, and chemicals, including research chemicals, is being considered by a committee of the British Science Guild, of which Sir Richard Gregory is chairman. In view of the conflicting statements which have appeared from time to time on these matters, the committee is anxious to obtain the views of scientific workers who have experience of recent articles of the kind described, both of British and foreign manufacture. It is obvious that the information can be of use only when it applies to goods of definitely known origin. The points on which information is desired are:—The quality of the goods; their price as compared with that of imported articles of the same quality; the facilities for obtaining supplies; and the effects, if any, on research work of restrictions imposed on the importation of German goods. The committee would also welcome statements made, or reasoned conclusions arrived at, by competent bodies which have investigated these questions recently, and from manufacturers who wish to add any further definite information to that which has already appeared in the Press. The information should be sent as soon as possible to the secretaries of the committee, Prof. J. R. Partington, East London College, or Mr. C. L. Bryant, 23, Peterborough Road, Harrow.

Carbon Monoxide Poisoning.—With the object of obtaining accurate data concerning the after-effects of inhaling carbon monoxide, and their influence on loss of working time, a systematic survey has been made in eight States of America of cases occurring in metalliferous mines, coalmines, engine-rooms, and in industries using blast furnaces and producer-gas boilers. It was found that carbon monoxide rarely causes late after-effects following acute gassing and that when such effects do appear, there is nearly always evidence of a pre-existing pathological condition. Frequent exposure to carbon monoxide causes headache and malaise, but no evidence of a cumulative harmful effect was obtained;

permanent compound with hæmoglobin. A certain tolerance to the gas can be acquired, owing to the compensatory increase of hæmoglobin and red cells, induced by prolonged want of oxygen. An advance in treatment has been made by adding carbon dioxide to the oxygen inhalations administered, recovery being three times as rapid as when oxygen is used alone. The U.S. Chemical Warfare Service has perfected a portable respirator which is effective even at 0° C. against 1 per cent. of carbon monoxide; its life is approximately three hours.—(*J. Ind. Hygiene, May*, 1921.)

"Zinc (1913—1919)," issued in pamphlet form (112 pp., price 3s. 6d. net) by the Imperial Mineral Resources Bureau consists of a digest of statistical and technical information relative to the production and consumption of zinc in the British Empire and foreign countries. The fact is emphasised that within the Empire are to be found some of the largest deposits of zinc ore in the world, viz., Broken Hill, Australia, Bawdwin Mines of Burma, Rhodesian Broken Hill and British Columbia. Yet, prior to the war, these ample resources of raw material were little utilised by British smelters. In England, ores imported chiefly from Spain, Algeria and Sardinia were mostly used. The only plant treating Broken Hill concentrates was that at Seaton Carew, where the concentrates are roasted and the zinc distilled, sulphuric acid being recovered as a by-product; and the only smelter plant in the Empire, other than in England, was at Port Pirie, Australia.

The usual valuable bibliography is given to cover the period, and an interesting feature of the publication is an appendix occupying seven pages on "The Zinc Industry at the close of 1919," by Mr. Gilbert Rigg of the Broken Hill Associated Smelters. Mr. Rigg, who discussed the subject from both the technical and economic points of view, expresses the opinion that, although many improvements had been effected in the distillation process resulting in increased capacity, fuel economy, and improved recoveries, the electrolytic process, perfected and developed during the war by such companies as the Anaconda Copper Co., U.S.A., and the Trail Consolidated Smelters, Canada, that were previously in no way concerned with zinc production, had come to stay. On the other hand, the electrothermic process can be considered as hardly taking rank with the distillation and electrolytic methods, the successful condensation of the zinc vapour being even more difficult and complicated than in the distillation process.

Industries in Egypt.—Although essentially an agricultural country, Egypt possesses a few manufacturing industries and the Government is doing all it can both to strengthen those already existing and to foster new ones. A Government Bureau of Commerce and Industry has been organised for the promotion of native industries, and the Department of Technical Industry and Commercial Education controls 17 trade schools which are turning out skilled manual workers. Among Egyptian industries, sugar-refining takes first place. This industry is monopolised by a company with a capital of 114 million francs which owns a refinery with an annual capacity of 100,000 tons of sugar. During 1918, 79,488 t. of sugar and 37,330 t. of molasses were produced from 814,842 t. of cane. Alcohol is produced from molasses at a distillery with a capacity of about 2,200,000 gallons per annum. An export trade in alcohol was built up prior to 1917 when exportation was prohibited. Small quantities of such by-products as potassium carbonate, chloride and sulphate, and carbon dioxide are produced, and sugar-straw is manufactured for use as fodder. The cottonseed-crushing industry is of some importance, but only local requirements are supplied; the equipment of the mills is mostly modern and an oil of good quality is produced for edible purposes or for the manufacture of a low-grade soap. Tanning and leather-working are widely practised, pottery is still a flourishing industry, and the manufacture of cement is increasing in importance; bricks and tiles are made at El Widi, south of Helwan, and an impure fireclay is worked at Assuan. Factories for the manufacture of paper, rubber, etc. have been established in recent years, and brewing as well as the distillation of potable spirits is carried on. The most important mineral product is petroleum, the output of which has risen from 12,786 t. in 1913 to 281,885 t. in 1918. Hurghada is the chief producing centre and the oil is refined at Suez in a plant with a daily capacity of 1200 tons. In view of the growing importance of oil fuel, further prospecting work is to be carried out. The mining of phosphate rock is also of growing importance.

Cost of Fixed Nitrogen in Norway.—T. C. Hagemann, consulting engineer to the Norwegian nitrate industry, Christiania, has given the following approximate figures of costs for the arc process of nitrogen fixation in order to show that this process is profitable in Norway.

Assuming a yield of 540 kg. of nitric acid (calculated at 100 per cent. per kw.-yr., or 62·5 g. per kw.-hr.), a medium-sized factory (about 40,000 kw.) in Norway will produce yearly about 20,000 tons of nitric acid, equivalent to 4500 t. of nitrogen, in the form of 29,000 t. of Norwegian saltpetre (13% N) and 4400 t. of sodium nitrate (16·5% N). The approximate running expenses are (krone = 1s. 1½d. at par):—

	£
Power, 40,000 kw. at 12s. 6d.	225,000
Administration and wages	84,375
Raw materials, etc.	61,875
Packing	56,250
Sundries	22,500
Total	£450,000

The raw materials required are limestone 15,000 t., lime 500 t., and soda 2500 t. The market price of the nitrogen in the above-mentioned products is about £168 15s. per ton, so that 4,500 t. would sell at £759,375. The profit, therefore, is £309,375, and assuming that the capital invested be about £1,125,000 and amortisation charged at 7½ per cent., the total net profit would be £225,000. As power represents half the running expenses, this item, together with the future yield, is vitally important when considering the cost and returns of any individual factory. Calcium nitrate is now being exported from Norway in increasing amounts. —(*Chem and Met. Eng., March* 23, 1921.)

The Sulphur Industry in Sicily.—The year 1920 was marked by considerable increases in the production and exportation of Sicilian sulphur; production rose from 181,744 to 240,857 metric tons, the exports increased from 147,286 t. to 188,865 t., and stocks at the end of the year were 147,900 t. as against 137,100 t. in 1919. Relatively good as these figures are, they compare badly with those for 1914, when 340,700 t. was exported and stocks mounted to 359,800 t. Exports to France have decreased from 60,700 t. in 1914 to 37,100 t. in 1920, to Austria from 25,300 t. to 700 t., to Germany from 18,800 t. to 4,700 t., to Russia from 21,200 t. to 2,200 t., to Scandinavia from 25,200 t. to 4,800 t., and to England from 12,900 t. to 11,600 t. On the other hand exports to Spain and Portugal have increased from 21,400 t. to 30,700 t., and to South America from 900 t. to 8000 t. Exportation has naturally been affected by the fluctuating exchange, but the increasing competition from Louisiana sulphur will, it is anticipated, bring about a reduction in prices.—(*Chem. Ind., Apr.* 25, 1921.)

Saltpetre Deposit in the Sahara.—The scarcity of saltpetre in France during the war induced the French Government to send out a technical commission in 1917 and 1918 to investigate the saltpetre deposits situated in the Sahara between Sba and Ouled-Mahmud. Disappointing results were obtained by the Commission, the reserve of saltpetre earth being estimated at only 900 tons. About 60 tons of saltpetre was obtained from this source during the war with an average composition of KNO_3 53—55%, $NaNO_3$ 31—33%, $NaCl$ 2—6%, sodium, calcium, and magnesium salts being also present in small amounts. In view of the small value of the deposits the Commission, which continued its investigations until November, 1919, has advised the French Government to discontinue development work. The product differs from Chile saltpetre chiefly in its high but fluctuating content of potassium nitrate.—(*Chem. Ind., Apr.* 25, 1921.)

Electrolytic Sodium Perborate.—According to a recent patent of the Norwegian firm Fredrikstad Elektrokemiske Fabriker, the process for manufacturing perborate by electrolysis has been simplified and rendered more efficient by employing an electrolyte containing, besides borax, a certain amount of sodium cyanide. Hitherto, concentrated solutions of borax and a large amount of sodium carbonate have been considered necessary for success and the presence of certain metallic impurities has diminished the current efficiency. These difficulties, it is claimed, have been surmounted, so that a dilute solution of borax may be employed, and the presence of sodium cyanide in the electrolyte prevents metallic impurities from bringing about the decomposition of the perborate and thus diminishing the yield. The process appears to be a marked improvement on those already introduced for the manufacture of this valuable per-salt.—(*J. of Commerce, N.Y., Apr.* 21, 1921.)

Mexico in 1920.—The Ensenada district of Mexico includes a large part of Lower California where there are large undeveloped deposits of gold, silver, copper and iron. Copper ore is produced at the El Boleo mine near Santa Rosalia, which is owned by French and Dutch interests and is said to have supplied over 100,000 tons of metal since it was started in 1887. At the present time seven reverberatory furnaces and a 150-ton oil furnace are being used. The Alamos gold district, formerly very important, is being re-opened, silver is being mined near La Paz, magnesite near Magdalena Bay, manganese near Mulege, and tungsten at Real del Castillo. Near Santa Catalina there is an onyx quarry said to be the largest deposit of the kind. Petroleum has not been found in Lower California, but indications are said to be favourable and American, British and Mexican interests have acquired concessions. Another product of this district is sea-bird guano, of which 478 tons was exported in 1919 and 234 t. in 1920. The only resources of the Frontera district are agricultural and forest products; in 1920 the production of cacao amounted to 1473 t., the largest crop since 1913, and that of unrefined sugar to 3000 t. The possibilities of sugar production in the State of Tabasco are very great; and two companies are prospecting for oil, which is believed to occur in large quantities. Henequen fibre is the chief industry of the Progreso district and constitutes about 98 per cent. of the total exports. Although 154,248 t. of fibre was exported in 1920, the actual production was about 126,298 t. The Vera Cruz district is essentially agricultural, producing coffee, vanilla, chicle, and hides. Owing to the bad weather the vanilla crop is expected to be only one-half of that of last season's (about 142 t. of beans). The crop of chicle is very poor, and the production of hides has been much reduced by the destruction of livestock during the revolutions.—(*U.S. Com. Rep., Mar.* 23, 1921.)

PARLIAMENTARY NEWS.

HOUSE OF COMMONS.

Paper-making Industry.

In a written answer to Rear-Admiral Adair, Sir P. Lloyd-Greame said that at present many paper mills were either closed down or working short time, owing to the high cost of raw materials, the increasing amount of paper imported, and the decline in demand. In so far as foreign competition was from countries with depreciated currencies, no industries other than food industries would be excluded from the provisions of Financial Resolution No. II., relating to the safeguarding of industries.—(May 24.)

Oil-boring in Great Britain.

Replying to Major Kelly, Sir R. Horne said that of the eight boreholes completed, one was producing oil in commercial quantities and the remaining seven were being closed down; three other borings were still in progress. The date of termination of the agreement with Messrs. S. Pearson and Sons, Ltd., depended largely on the settlement of the question of the ownership of the petroleum discovered, in respect of which legal proceedings were pending. In the meantime, expenditure was being reduced.—(May 24.)

Coal Imports.

Mr. Bridgeman, in answer to Mr. W. Thorne, stated that the import of coal into the United Kingdom in 1920 amounted to 3671 tons, of an average c.i.f. value of 145s. 1d. per ton. During January, February, and April, 1921, the imports were 142 t. (80s. 5d.), 5591 t. (47s. 8d.), and 2818 t. (58s. 2d.), respectively. No coal was imported in March, 1921.—(May 26.)

In reply to Mr. J. Guest, Mr. Bridgman said that since the stoppage of work in the mines 94,000 tons of German reparation coal had been imported into this country. He was not aware that the German Government had protested against the exportation of this coal by France and Belgium.—(June 1.)

Subsidies to Rubber Planters.

In reply to Sir W. de Frece, Mr. Churchill said that he understood that certain foreign Governments granted a subsidy to rubber planters under their jurisdiction. He was not aware that a similar action was contemplated in any British Colonies.—(May 31.)

Home-Grown Sugar, Ltd.

Answering Mr. Wise, Sir A. Boscawen said that the value of the property, including the factory, estate, farm stock, etc., of Home-Grown Sugar, Ltd., was £447,659 on March 31 last. Shares had been issued to between 500 and 600 shareholders to the amount of £500,000, of which £498,415 15s. had been paid up. There were no debentures, but the company was negotiating a first mortgage of £75,000 to be secured on the property (*cf.* J., 1921, 108 R).—(May 31.)

British Dyestuffs Corporation.

Capt. W. Benn asked the President of the Board of Trade whether the British Dyestuffs Corporation had refused to supply British export firms with synthetic indigo on the ground that the Corporation had its own agents in the Far East; and what steps the Government proposed to take in the matter. Sir P. Lloyd-Greame replied to the effect that the arrangements made by the British Dyestuffs Corporation with its agents in China preclude the sale of its products to merchants in this country when the goods are destined for export to, and sale in, China. Merchants who supply the Chinese market can, however, obtain their supplies through the Corporation's agents in that country without disclosing information as to the ultimate purchasers. The Government is not responsible for the management of the British Dyestuffs Corporation and the Board of Trade has no power to dictate to firms the terms of their agency agreements.—(June 6.)

The Jamaican Citrus Industry.

Mr. Churchill, answering Mr. Hard, said that he had received suggestions from the Governor of Jamaica to the effect that the citrus-fruit industry of the Colony would be benefited if the Canadian Government would grant certain facilities in addition to those provided under the Canada-West Indies Agreement; correspondence was now proceeding with the Dominion Government on the subject.—(June 1.)

Safeguarding of Industries Bill.

During the debate on the financial resolutions, which form the basis of the Bill, Mr. Wise (Ilford) argued in favour of the 33⅓ per cent. import duty on fine chemicals. In his constituency there was a large chemical factory, established in 1797, which was feeling German competition so acutely that it had almost closed down and about three-fourths of its workers was unemployed. Mr. A. M. Samuel said that the world's production of optical glass did not amount to 50 tons, valued at about £50,000 at present, but that amount would suffice for the manufacture of optical instruments worth £30,000,000; the production of this indispensable commodity should not be allowed to pass out of our hands. Criticism was levelled against the quality of the arc-lamp carbons produced in this country, but Sir P. Lloyd-Greame said that they satisfied Admiralty requirements.

The debate on the second reading of the Bill was held on June 7 and 8, and the motion for the second reading was passed by 312 votes to 92.

LEGAL INTELLIGENCE.

Alleged Infringement of German Sulphur-Black Dye Patent. *A.-G. für Anilin Fabrikation in Berlin v. Levinstein, Ltd.*

On May 9 the Court of Appeal, consisting of the Master of the Rolls and Lords Justices Warrington and Younger, dismissed an appeal by the A.-G. für Anilin Fabrikation in Berlin and the liquidator of the Mersey Chemical Works from a judgment given by Mr. Justice Sargant in February, 1914, dismissing the action brought by them against Levinstein, Ltd., for alleged infringement of a patent (1151/1900) for the manufacture of Sulphur Black dyes.

Counsel for appellants said that the patents taken out from 1873 onwards for processes of manufacturing dyes involving reaction between an alkali sulphide, sulphur, and an organic substance culminated in the Cassella patent of 1896, which, however, never came into use in this country. In these processes melting was necessary, and in 1900 appellants patented a process in which, although the reagents employed were the same as those specified in the Cassella patent, the melting was replaced by boiling. According to the appellants' specification, sodium sulphide and dinitrophenol were to be used, but in practice these were replaced by sodium dinitrophenolate. As the respondent company had not used dinitrophenol but its sodium salt, it had been held that there was no infringement. Appellants, however, claimed that the respondents' process was a colourable imitation of theirs and that the two processes were chemically identical.

For the respondent company it was submitted that the Cassella process was not a melting process but a boiling process, and that there was no subject matter for the appellants' patent. If, however, the Judge was right in holding that there was sufficient invention in that patent to give it subject matter, then it followed that the use of the sodium salt in the Levinstein process gave it sufficient distinction from the appellants' process to make it impossible to allege infringement. All arguments to show that there was subject matter applied equally to show that there was no infringement.

In dismissing the appeal Lord Justice Warrington said that the defence of insufficiency of subject matter and insufficiency of description failed. The main issue was that of infringement, and the Court had concluded that the appellants' specification was confined to a process of boiling dinitrophenol. The use by Levinstein, Ltd., of sodium dinitrophenolate was a different process, and the boiling of this salt with the solution mentioned in the appellants' specification would not be covered by their patent unless it could be proved that this process was common knowledge in 1900, the date of the patent. Appellants had not shown this, and their claim for damages for infringement failed.

REPORTS.

Report of the Industrial Alcohol Committee, India, 1920. *Pp.* 62. (*Simla: Superintendent Government Central Press.*)

The Industrial Alcohol Committee was appointed to consider and report on the extent to which the existing excise regulations in India would require amendment in view of the possibility that the large-scale manufacture of industrial alcohol might be undertaken in the near future. The Committee found that the existing regulations, although adequate at present, would need alteration; that restrictions in production would have to be maintained even if those on sales, storage and transport were relaxed; that one possible obstacle to the manufacture of industrial alcohol is the seeming confusion of the rules concerning it; and another the restriction imposed by the Railway Board on the transport of alcohol in tank wagons which should be abolished.

The recommendations of the Committee include the following, among others:—Experiments should be made to determine if alcohol 55° overproof, denatured with 0·5 per cent. caoutchoucine, 1 per cent. pyridine, and a certain proportion of methyl violet, can be safely released from all excise restrictions except those regarding renaturation; and if such experiments prove successful, further tests should be undertaken to ascertain if spirit so denatured could be used advantageously in internal-combustion engines. If these further experiments were also satisfactory, or a better denaturant were discovered, a standard denaturant should be adopted for power alcohol throughout the whole country: such alcohol should be exempted both from excise duty (whether it be made in the country or be imported and then denatured) and from duty under the Motor Spirit Act. Power alcohol should be transported by rail on the same terms as dangerous petroleum; and special licences should be granted for the use of rectified or specially denatured spirit in industries.

An appendix to the report contains, in tabular form, a list of industries in which alcohol is used, the form of alcohol which might be employed, the suggested place of denaturation, and suggested methods and formulæ for industries requiring specially denatured spirit.

Report on the Commercial, Industrial and Economic Situation of Italy in 1920. *By* Sir E. Capel Cure, *Commercial Counsellor, and* J. H. Henderson, *Commercial Secretary to H.M. Embassy, Rome. Pp.* 48. *Department of Overseas Trade. London: H.M. Stationery Office.* 1921. *Price* 1s.

The war left Italy in a disorganised and exhausted condition, but as natural resources and advantages, except possibly that of cheap labour, are still intact, eventual recovery may be anticipated; the chief obstacles thereto at the present time are labour unrest and depreciated currency. In 1919 industrial materials formed 52·5 per cent. of the imports, foodstuffs 32·2 per cent., and manufactured articles 15·3 per cent., these figures comparing with 57·3, 23·4, and 19·3 per cent., respectively, in 1913. The excess of imports over exports rose from 1134 million lire in 1913 to 11,328 millions in 1919, but there was a notable improvement during the first eight months of 1920. In 1919 the share of the United States in the foreign trade was 50 per cent. of the imports and 9 per cent. of the exports; that of Great Britain was 14 and 13 per cent., respectively. Germany, formerly first, now takes the sixth place with a volume of trade one-sixth that of the United States and one-fourth that of Great Britain. Germany supplies chiefly machinery, iron and steel, dyes and small hardware goods, and appears to be rapidly regaining its former ascendancy. There has been an enormous increase in the capitalisation of joint-stock companies since 1916; this still continues, and will undoubtedly be a grave source of danger when prices and profits decline; the net increases, in millions of lire, of chemical companies were 172·1 in 1918 and 133·2 in 1919, and of metallurgical companies, 725·5 and 214·2, respectively. Concomitantly, the values of industrial securities have seriously depreciated; in the chemical industries the index number fell from 100 in December, 1919, to 78·59 at the end of October, 1920, and that for the iron and steel industry from 102·49 to 51·10.

Agriculture showed a significant improvement in 1920, but as over 90 per cent. of the country is already cultivated, increased production will only be achieved by improved methods of cultivation. The annual production of citrous fruits, of which 52 per cent. is lemons, is about 800,000 metric tons, and that of essences and calcium citrate about one-tenth of the world's output. The sugar-beet, but recently introduced, is now cultivated on a large scale, and the national factories are producing nearly sufficient sugar to meet the home demand. Increased production of fertilisers and development of hydro-electric power are signs of the progress being made; but many years must elapse before the latter can have any marked effect on industrial productivity. A Government commission has been appointed to investigate Italian fuel resources, but it is doubtful if the results will justify the heavy expense, especially for boring, that will have to be incurred. Mineral production is probably much lower than the potential output, and the mineral wealth of the redeemed provinces is unlikely to affect the general position. During 1919 Venezia Tridentina and Venezia Giulia produced:—Copper ore, 26 metric tons; lead ore, 1082 t.; zinc ore, 20,149 t.; iron pyrites, 100 t.; mercury (metal), 297 t.; lignite, 93,300 t.; coal, 870 t.

OFFICIAL TRADE INTELLIGENCE.

(From the Board of Trade Journal for May 26 and June 2.)

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W. 1, from firms, agents or individuals who desire to represent U.K. manufacturers or exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department and quoting the specific reference number:—

Locality of firm or agent	Materials.	Reference number.
British West Indies	Drugs, bottles, chemicals for confectionery and aerated water trades	667
Canada	Vegetable colours for jam and confectionery, dyes for textiles, pigments	641
,, ...	Pigments, dry colours, lithopone, litharge, zinc oxide, china clay	646
,, ...	Medicated confectionery	668
,, ...	Insulating varnish..	671
,, ...	Mining supplies	674
,, ...	Chinaware	675
Egypt	Calcium carbide (tender for) ..	—
Italy	Metals	686
Spain	Tinplate	657
,, ...	Rubber	658
Smyrna	Sugar, paper, chemicals, carbide, petrol, pottery, glass, perfumery	660
South Africa ..	Paper	680
Netherlands East Indies	Chemicals	9744 F.W./P.N.
United States ..	Dry white lead	697
Argentina	Heavy and fine chemicals ..	664

Markets Sought.—A company in eastern Canada about to manufacture milk powder wishes to arrange for sale in the U.K.

[Inquiries to the Canadian Government Trade Commissioner, 73, Basinghall Street, London, E.C. 2.]

TARIFF. CUSTOMS. EXCISE.

Australia.—Recent customs decisions affect glucose, perfumed spirit, candles, matches, and paraffin wax.

Belgium.—The import of malt and the export of malt and matches are now permitted without licences.

British West Africa.—The import duty on spirits has been increased.

Canada.—It is proposed to amend, as from May 10, the import duties on cocoa, chocolate, coconuts, sugar, alcohol, spirits, and perfumes.

Denmark.—The export of potash and potash salts is allowed as from May 3.

Ecuador.—Sugar may now be exported subject to an export tax of 15 per cent, *ad valorem.*

France.—Until further notice the export is permitted of margarine, edible vegetable fats, bauxite, and iron ore.

French West Africa.—The import is prohibited of "trade spirits," thuyone, badian, benzoic aldehyde, salicylic ether, hyssop, and absinthe.

Germany.—Entry permits are required on entry into unoccupied Germany from occupied Germany of cocoa, cocoa husks, chocolate, artificial honey, refined sugar, margarine, compound lard, fertilisers, artificial sweetening matter, rubber tubing and tyres, asbestos wares, etc.

Jamaica.—The export of cocaine, opium, and certain explosives is prohibited to all destinations other than the British Empire.

Latvia.—Special export licences are no longer required for lime, gypsum, pottery, cardboard, cork, china, glassware, matches, soap, syrup, tar, turpentine, varnish, and window-glass.

Mexico.—The import of oleostearin is duty free.

Netherlands.—Export prohibitions have been withdrawn from ferruginous earth containing sulphur, and potassium salts.

New Caledonia (French).—The export duties on raw hides and skins and copra have been abolished, but minerals, whether in the form of ore or matte, pay 3½ per cent. *ad valorem.*

Paraguay.—The export duty on quebracho extract has been reduced to $3 (gold) per metric ton.

Peru.—Vanadium ores with less than 10 per cent. of vanadic acid may be exported duty free.

Spain.—The full text of the new provisional Customs Tariff is issued as a supplement to the issue of May 26. The tariff is to remain in force pending a further revision of a more permanent character and is operative as from May 21.

All classes of goods are affected, and in most cases the duties are increased. Among the articles on which the duties have been reduced are chinaware, perfumery, spirits, and rubber wares. Additional surtaxes are levied on petroleum, coconut oil, palm oil, indigo, manilla hemp, agave, jute, raw hides and skins. Export duties are payable on cork, bones, galena, litharge, lead ores, argentiferous lead, iron ore, copper ore and copper matte. Sheet, plate, and crystal glass when imported coloured, bevelled or engraved pays in respect of each such operation a surtax of 10 per cent. of the duty applicable. Bimetal sheets are classed under the heading of the more highly taxed metal. Tarred or impregnated timber pays the duty applicable plus a surtax of 10 per cent.

Sweden.—Export prohibitions have been withdrawn from mineral and lubricating oils.

It is proposed to increase the import duties on many classes of goods. The schedule of articles affected is set out in the issue of June 2.

United States.—The Emergency Tariff Bill became effective on May 28. For a period of 3 months the admission is prohibited of sodium nitrite, dyes, crudes or intermediates, products derived directly or indirectly from coal tar, and synthetic organic drugs or chemicals, unless a satisfactory substitute therefor is unobtainable in the United States.

GOVERNMENT ORDERS AND NOTICES.

German Reparation (Recovery) Act.—An Order has been issued by the Board of Trade under the above Act exempting from its provisions any article proved not to have been first consigned from Germany to the United Kingdom. Goods are regarded as consigned from the country where they were last owned, and from which they were procured by the importer. The Order No. 5 has been cancelled.

Leather Measurement Regulations, 1921.—In view of the increasing use of leather-measuring instruments in the leather trade, regulations have been made by the Board of Trade under the Weights and Measures (Leather Measurement) Act and will come into force on July 1. After that date every leather-measuring instrument of an approved pattern must, if used for trade, be verified and stamped by an Inspector of Weights and Measures within a period of twelve months.

TRADE NOTES.

BRITISH.

British Guiana in 1919.—Owing to scarcity of labour, bad weather, and shortage of nitrogenous fertilisers, the sugar crop amounted to only 86,971 tons, of which 83,140 t. was exported, mainly to the United Kingdom. The acreage under cacao remained at about 2000 acres, but the planting of Para rubber decreased. Para rubber grows well on suitable lands in the colony and gives good yields, but is susceptible to leaf disease. Balata bleeding was continued and 627·3 t. was exported. Coconuts are now planted over 27,400 acres, an area which could be greatly increased; 4,693,000 nuts, 68 tons of copra, and 9120 galls. of coconut oil were exported. Limes are cultivated over about 1350 acres, and the erection of factories for the production of concentrated juice and citrate of lime has given the industry a much-desired impetus; the exports were 389·5 cwt. citrate of lime, 7356 galls. of raw and 2882 galls. of concentrated lime juice, and 326 galls. of oil of limes. During the year 16,216 oz. gold and 16,706½ carats diamonds were produced, and eight licences were issued for mineral oil exploration in the north-western and Pomeroon districts, but no definite results were recorded. The principal exports include sugar, rum, molasses, molascuit, rice, and citrate of lime. Leather, cacao, and matches are manufactured, and there is a large ice factory. The value of the exports was £4,240,832, an increase of 20·21 per cent. on 1918, and imports were valued at £3,590,812. The United Kingdom takes first place with 34·13 per cent. of the total trade of the colony, followed by Canada and the United States with 30·54 and 17·96 per cent., respectively.—(*Col. Rep.—Ann., No.* 1068, *Mar.*, 1921.)

FOREIGN.

Imports of Chemicals into the Dutch East Indies.—H.M. Commercial Agent at Batavia, Netherlands East Indies, has supplied the Department of Overseas Trade with the following statistics relating to imports of chemicals into the Netherlands East Indies during 1919.

The following statement shows the quantity and value of the various chemicals imported into the Dutch East Indies during 1919:—

	Quantity. Metric tons.	Value. £
Alum	1,620	16,190
Ammonia	33	9,080
Acetic acid	221	31,310
Calcium carbide	767	32,830
Caustic soda	2,869	99,030
Sodium nitrate	84	2,670
Sodium sulphate	1,791	35,440
Copper sulphate	46	2,080
Sulphur	3,293	43,910
Sulphur pyrites	9,160	48,180
Sulphuric acid:—		
Commercial	914	17,460
Refined	38	1,210

Imports into Java and Madura were valued at 3,745,972 fl. (£331,500) and those into the outlying possessions at 2,431,373 fl. (£215,000), making a total of 6,177,435 fl. (£546,500) for the whole of the Netherlands East Indies. Direct imports from the United Kingdom totalled 1,165,631 fl. (£103,150) or approximately 18·5 per cent., but the imports from Singapore amounted to nearly 15 per cent. of the total, and it is probable that a considerable portion of this represents chemicals in transit from the United Kingdom. Japan supplied 30 per cent. of the total chemicals imported, a large item being sulphur pyrites (529,966 fl.) imported by the Bataafsche Petroleum Mij. for its sulphuric-acid plant at Balik Papan in Borneo. The share of the United States was approximately 25 per cent., one-third of this total consisting of caustic soda and one-third of chemicals not enumerated.

Owing to the advance of scientific agriculture, the development of new plantations and the opening up of new industries, the chemical trade of the Netherlands East Indies is of growing importance. Competition for this market from Japan and the United States of America has to be considered, and Germany is already sending out agents in an endeavour to regain the trade lost during the war. United Kingdom firms are advised to send out representatives to canvass the market and be in a position to quote c.i.f. prices for immediate or forward delivery. As an alternative, much might be done by forwarding catalogues to H.M. Commercial Agent at Batavia for delivery to chemical importers, or by advertising in the East Indian Press. Catalogues and advertisements, however, would be of little value unless prices were quoted. It should be possible not only to maintain United Kingdom trade in chemicals with the Netherlands East Indies, but also to increase it, as there is every indication that the Japanese are losing their hold on the market, which is gradually favouring the United States and Germany. The names of importers of chemicals in the Netherlands East Indies and of United Kingdom advertising contractors may be obtained on application to the Department of Overseas Trade (Reference No. 9744.F.W./P.N.).

The Dutch Soap Trade in 1920.—Although in normal times soap is manufactured and exported from Holland in large quantities, there is a considerable import trade, particularly in toilet soaps. During 1920 imports declined and the export trade recommenced Imports of various grades of soaps, together with the chief countries of origin, are given below:—

	1919.		1920.	
	Metric tons.	Per cent.	Metric tons.	Per cent.
Scented, transparent, and liquid	604	U.K. 34, U.S. 59, Belg. 2	621	U.K. 43, Fr. 12, Ger. 11·5, Belg. 11, U.S. 10
Hard, unscented, and powder	2,348	U.K. 95, U.S. 5	691	U.K. 50, U.S. 50
Soft	31	—	70	—
Textile	12	—	6	—

The figures for 1919 include the transit trade, but those for 1920 do not; the volume of this trade is about 20 per cent. of the figures given for 1920. Exports in 1919 and 1920 were as follows:—

	1919.		1920.
	Metric tons.		
Scented, etc.	216	..	432
Hard, unscented	2,524	..	3,521
Soft	130	..	229
Textile	—	..	28

The percentage representing transit trade should be added to the returns for 1920. About 75 per cent. of the exports of toilet soap in 1920 went to the Dutch East Indies, and the balance to Belgium and Germany; and of the hard soap exported, 40 per cent. went to Germany, and the rest mainly to Poland, Scandinavia, and the Dutch East Indies, in the order named.—(*U.S. Com. Rep., Mar.* 19, 1921.)

Foreign Company News.—*Brazil.*—It is reported that a large cement works is being constructed at Belem, Para, for the Companhia Para-Ceara, which intends to produce cheap cement for the reclamation work to be carried out in the State of Ceara.—(*U.S. Com. Rep., Apr.* 13, 1921.)

Germany.—The Oberschlesischen Kokswerke und Chemische Fabriken A.-G. has made a profit of 16,890,855 mk.; a dividend of 17 per cent. has been declared and 886,419 mk. carried forward (capital 6,800,000 mk.).

The net profit for 1920 of the Rütgerswerke A.-G. in Berlin was 4,802,661 mk.; 3·8 million mk. has been written off and 3 million mk. carried to maintenance account. The dividend is 15 per cent. (12½ per cent.) and bonus 150 mk. (capital 37,500,000 mk.).

With the co-operation of the Chemische Fabrik auf Aktien (vorm. E. Schering) in Berlin, the Richard Jahr dry-plate factory has been converted into a limited liability company with a capital of 2·4 million mk.—(*Chem. Ind., Apr.* 18, 25, 1921.)

Poland.—The Polish Chemical Works in Cracow (capital 50 million mk.) has begun to erect a factory at Bogumin (Oderberg) for the manufacture of saccharin and other chemical products.

A company to manufacture explosives has been founded under the name of the "Nitrat" Chemical Works (capital 300 million mk.) by the A.-G. Pocisk and the Tomaszower Artificial-Silk Works.—(*Chem. Ind., Apr.* 18, 1921.)

Sweden.—The proposal to manufacture pharmaceutical products at a central laboratory connected with the A.-B. Svenska Färgämnesindustrie in Södertälje (*cf.* J., 1921, 33 R) has been abandoned, and it is now proposed that such a laboratory be attached to the Svenska Medicinalväxtföreningen, a company which owns a large works at Ljungby. If this takes place the sale of pharmaceutical products in Sweden will become centralised.—(*Chem. Ind., Apr.* 18, 1921.)

United States.—The net profit of the Allied Chemical and Dye Corporation in 1920 was $16,179,939. A dividend at the rate of $6·33 per share has been declared on the 2,143,455 shares of common stock.—(*Oil, Paint and Drug. Rep., May* 16, 1921.)

The Manito Chemical Co. has recently completed a plant at Manito, Illinois, which is stated to be one of the largest plants for preparing natural humus in the world. It is situated on a bed containing over one million tons of humus; the product is black, completely decomposed, and contains 12—14 per cent. water and 3—5 per cent. ammonia.—(*Amer. Fertiliser, Mar.* 26, 1921.)

COMPANY NEWS.

British Cyanides Co., Ltd.—The directors announce that owing to the industrial situation they are unable to recommend the payment of a dividend on the ordinary shares. The company's works are closed owing to lack of coal, but work on the plant for the fixation of atmospheric nitrogen is being continued and nearing completion.

Jurgens, Ltd.—The profit for the year 1920 was £377,467, as against £222,040 in 1919. Including the amount brought forward the available balance is £446,280, from which £254,206 has been applied to the writing down of stocks to market value, an amount equivalent to a 10 per cent. dividend on the ordinary shares, upon which no dividend is payable. Satisfactory progress is reported at the company's factory at Purfleet.

British Cottonseed Products, Ltd.—At the first annual meeting held on May 23, the chairman stated that the company now owned the whole of the world's rights for the seed-defibrating machine (*cf.* J., 1918, 112 T, 1919, 464R), with the exception of the United States; and that it was hoped to launch the Indian company during the present year. The erection of plant and machinery in the works at Chatham had been delayed, and in view of the high price of local electricity supply, the company had decided to erect a power-plant of its own.

Cape Explosives Works, Ltd. has successfully issued £1,000,000 of 7½ per cent. first mortgage debenture stock at 95 per cent., the repayment of which is guaranteed by De Beers Consolidated Mines, Ltd. The company's works are situated at Somerset West, Cape Province, S. Africa, and its manufactures include explosives, fertilisers, sheep and cattle dips and other chemical products. A plant has recently been completed which is able to supply the whole of the Union's requirements in detonators, and the fertiliser plant is capable of producing 70,000 tons per annum. The issued share capital consists of 500,000 ordinary shares of £1 each, all of which are held by the De Beers Company, and the profits, before allowing for depreciation and taxation, have lately been at the rate of about £146,700 per annum, but the fertiliser plant has only recently come into operation.

National Dyes, Ltd.—The first annual report and accounts covering the period December 15, 1919, to December 31, 1920, were presented to the shareholders on June 6. The report shows that 786,703 lb. of colours and 306,848 lb. of intermediates were manufactured at the company's works during that period, which is considered satisfactory, especially having regard to the fact that the trade depression necessitated the complete closing down of the factories before the end of the year. The accounts show a gross profit, after making suitable provision for decline in market value of certain raw materials, of £62,098, and after writing off £13,034 depreciation on plant, tools and machinery, £17,080 debenture and bank interest, also bad debts, etc., a balance of £6,610 is carried forward to the debit of profit and loss account.

The British Oil and Cake Mills, Ltd.—Addressing the 23rd ordinary general meeting on May 31, Mr. J. W. Pearson, chairman, said that the coal strike had entailed no stoppage of the company's operations, as practically all the boiler plants had been converted to use oil fuel, approximately 75 per cent. of the entire output being obtained by this means; and that certain of the refinery refuse could be profitably burnt in the converted plant. Except at such expensive centres as London, he was doubtful of the superior economy of oil fuel; further north, where coal could be supplied at less than half the price in London, the advantage was entirely in favour of coal. The profit and loss account for the year 1920 shows a balance of £414,464, which with £22,010 brought in allows of a total dividend of 15 per cent. on the ordinary shares, compared with 25 per cent. for 1919, when the ordinary share capital was one-half of what it is now (£2,500,000). Stocks at the end of the year were exactly the same as at December 31, 1919, but the value was assessed at one-half.

British Cellulose and Chemical Manufacturing Co., Ltd.—A progress report states that the board has adopted the recommendations made by Mr. A. Chamberlain (a director) in December last which proposed an immediate and drastic restriction of programme, including the cancellation or postponement of the delivery of much plant. The present position is that plant to produce 1 ton of silk per day is nearing completion; the daily output is about 1000 lb., and it is expected to increase this to 1 ton by the end of August. To make provision for an output greater than 1 ton per day, the sum of £278,000 has been borrowed and secured by a debenture. Any further increase in output capacity will require further cash. The directors are quite satisfied with the quality of the silk, which dyes well and gives results in many respects superior to those obtained with other artificial silks. The Post Office has approved the use of the silk for insulating purposes. Owing to the importations of carbide and other chemicals from the Continent, the carbide and other chemical departments were closed down early in the year, but it is hoped to reopen them if the Safeguarding of Industries Bill becomes law and these branches of the company's work are included within its scope. The production of non-inflammable celluloid is making good progress.

REVIEWS.

(1) Economic Mineralogy. *By* Thomas Crook. *Pp.* xi+492. *(London: Longmans, Green and Co.* 1921.) *Price* 25*s. net.*

(2) Geology of the Non-Metallic Mineral Deposits other than Silicates. Vol. 1. Principles of Salt Deposition. *By* A. W. Grabau. *Pp.* xvi+435. *(New York and London: McGraw-Hill Book Co., Inc.* 1920.) *Price* 30*s. net.*

No single treatise can essay to cope with the facts and principles of so complex a subject as economic mineralogy or geology in a manner that will satisfy the needs of specialists; they have to turn to the books dealing with their specific subjects, it may be gold, zinc, oil, clay, and so on. The student who requires something more than a catalogue and less than a monograph is fairly well provided for by DeLaunay, Stutzer, Dammer and Tietze, Krusch and Beyschlag, and a goodly array of works on the genesis and distribution of ore minerals. But, judging by the recent output of such books, there is evidently a demand for a condensed practical guide to the study of useful minerals, and no book yet published in English has more successfully achieved this object or contains more information for its size than does Mr. Crook's mineralogy. Nothing, however, could illustrate more clearly than the two books under review the wide divergence that is possible in the treatment of the subject; the first is in effect a compact encyclopædia, the second is an attempt to treat one broad aspect of the subject philosophically, but with an ulterior economic motive.

(1) Mr. Crook begins with a very brief account of crystals and the general physical characters of minerals. He next explains the practical elements of crystal optics and this he does with unusual clarity. The simple chemical and blowpipe tests and laboratory methods of separation and concentration are adequately dealt with, though a little more might have been said about the employment of vertical and oblique illumination with white and monochromatic light in the study of opaque minerals in polished surfaces. Still, all this introductory matter bears the obvious mark of the experienced manipulator. The chapter on the geology of economic mineral deposits was perhaps necessary, it is of course just geology, and it was naturally impossible, in the allotted space, to give it proper treatment. In the descriptive portion of the volume the economic minerals are arranged in three groups: (1) ore minerals, (2) gem minerals, (3) miscellaneous minerals. Within each group the arrangement is alphabetical. By "ore mineral" the author means "a metalliferous mineral which owes its economic value to the fact that it is smelted to obtain a metal." This is not true, and if it were it would be misleading, for some of the metals included in this group are in practice more often extracted by electrolytic or purely chemical processes. Amongst the gem minerals are included many of little value or that are rarely employed. The miscellaneous minerals are described partly with reference to their uses, *e.g.*, abrasives, building stones, cement-materials, refractories; partly in accordance with their chemical classification, *e.g.*, carbonates, sulphates, silicates, borates, and partly under common mineral names, *e.g.*, asbestos, mica, clays. This section is full of information though in an abbreviated form; it is fairly well up-to-date but, as would be expected, there is some inequality in treatment; the remarks under building stones and cement materials, for example, do not take one very far; lime is mentioned under fertilisers, but there seems to be no reference to

chemical lime. Flint is almost passed by and it is not indexed. Useful determinative tables come at the end of the book. Cross references have been carefully made and the index is satisfactory, but there are no references to original authorities. Most of the illustrations are good and new.

(2) Any work from the pen of Dr. Grabau is deserving of attention and this will doubtless be true of the one now under consideration. In the author's own words, it is "essentially a treatise on applied stratigraphy." The present volume treats of the principles of salt deposition, as deduced from the study of such deposits now forming or which have but recently been formed. These principles are to be applied in a second volume to the elucidation of the older deposits. The term salt is used with a very wide connotation. The composition of natural saline waters is reviewed together with the laws governing the deposition of salts in nature. The investigations of Van't Hoff, Walther and others and the experiments of Usiglio are discussed. Different types of deposit are examined—sea-margin deposits, formations in lakes and cut-offs, cyclic or wind-borne salts, connate salts and those derived from pre-formed rock bodies. A chapter is devoted to the concentration of salts of different kinds by the vital activities of animals and plants, another to the deposits from mineral springs, fumaroles, and circulating ground-waters. The "meta salts," that is, those formed *in situ* by metasomatic processes, are disposed of rather briefly. The interesting and difficult subject of deformation in salt bodies has a chapter to itself.

As regards the principles of salt deposition, the author rather frequently avoids giving a definite lead, preferring to quote variant hypotheses and leave the choice to the reader.

Though this is only the first instalment of a rather ambitious scheme, and the final judgment upon it must be deferred, it will be found a very handy introduction to the study of salt deposits and the distribution of the younger salt formations. The numerous outline maps and references to literature enhance its value in this respect.

J. Allen Howe.

Traite de la Conservation et de l'Amelioration des Bois. *By* M. de Keghel. *Encyclopédie Industrielle. Pp.* 360. (*Paris: J.—B. Ballière et Fils.* 1921.) *Price* 10 *francs* (*bound* 15 *fr.*).

There have been very few works attempting to handle this important subject as a whole, although many papers or pamphlets have been written. In the present case the author has condensed into 360 pages of a handbook an enormous amount of information which could only be dealt with in many volumes.

The matter is divided under 18 headings or chapters. The first is historical and critical, and leads up to the final paragraph which states that a rational and complete impregnation of wood is only possible by the application of a system in harmony with a knowledge of its anatomical structure and histology. These subjects are dealt with in Chapter II which shortly goes into the cause of the circulation of the sap and the course it follows. After a few remarks on the cellular and vascular tissue and the chemical composition of wood, the author proceeds to show the difficulties in the way of thorough impregnation of all parts; and, in Chapter III, how these may be overcome. He proposes to drive out the sap by a longitudinal injection of a suitable fluid. Chapter IV describes the author's plant which provides for the immersion of the log in the fluid under the same pressure as is applied to one end, whilst the other end is open to atmosphere. This ingenious arrangement is to prevent the bursting of the wood under the high pressure necessary. Chapter V is on the selection and felling of the trees and the preparation of the logs for the special treatment, whilst Chapter VI, on the artificial ageing or senilisation of wood, is of very great interest. The changes brought about by natural and artificial ageing are explained and the reasons given for the failure of wood seasoned by the ordinary artificial methods. It describes several unsatisfactory processes which pretend to overcome these disabilities. All this leads up to the author's process of the removal of the sap and soluble constituents by forcing through the logs a weak aqueous solution of sulphoricinate of ammonia, etc., followed, after draining, by treatment with acetone. Subsequent drying in special plant results in the recovery of a very large proportion of the acetone, and the preparation of a wood which will not warp, swell or crack. The author shows that it is possible by washing to remove the hygroscopic soluble and putrescible matter from the woody structure, and that then the drying is rapid. He gives figures showing the differences in weight and time of drying of treated and untreated wood.

Chapters VII to XIII deal with fireproofing historically, chemically, and industrially. Failures are explained and the author's investigations leading up to his zinc-ammonio-phosphate solution are described.

Chapter XIV is a very long one handling the subject of wood preservation from the industrial point of view. It opens with about four pages on the causes of destruction, and then goes on to describe and criticise many of the processes which have been proposed or used for preservation. This naturally leads to the rational methods invented by the author, as exemplified by the longitudinal injection of an aqueous solution of agar-agar, formaldehyde, and ferrocyanide of potassium for railway sleepers, and a solution which will deposit sulphate of lime in the case of wood intended for paving.

Whilst the author's reasons for adopting such processes appear to be sound and to be supported by experimental data, it cannot be overlooked that he strongly condemns creosote as a preservative, making use of examples of inefficient application, and arguing that its viscosity and other disabilities make it impossible to cause it to penetrate the wood. He apparently ignores the fact that sleepers, telegraph poles, piling, and many other creosoted structural timbers have lasted much beyond their economical or mechanical life. Large fencing posts erected in 1854 are still sound. His comparative experiments with beech sleepers against white ant must be discounted. If the amount of time and care given to his agar process had been expended on the control sleepers which were creosoted, they would not have suffered.

Chapter XV is upon the colouring of wood, either to imitate others or to produce "fancy" effects. The author has given a great deal of thought to this subject, and his reasons for failures and proposals for obtaining successful results are supported by experiments. He introduces the theory of colloids to explain the unequal absorption of colouring matters, and how wood may be mordanted to render all its constituents of the opposite electric sign to that of the colouring matter. He explains how, in any haphazard mixing of colouring matters, the different viscosities of the constituents would result in selective separation in the capillaries; but he states that a complex of definite composition, more stable than either of the constituents, may be formed by mixing certain positive or basic colours with negative or acid colours.

There is a chapter on plywood, compressed wood, and bent wood, and finally, one on the installation of plants suitable for carrying out the author's ideas.

The diagrams and reproductions of actual plant are badly printed; otherwise the perusal of the book has been one of pleasure and instruction. It is to be regretted that the author has said little or nothing about the great plants of England and America, or of the large amount of work of investigation carried out by the American Wood Preservers' Association and others. This may be accounted for by the fact that most of these plants use the creosote process.

HUBERT FERGUSSON.

RED LEAD AND HOW TO USE IT IN PAINT. *By* A. H. SABIN. *Third edition, rewritten and enlarged. Pp.* xi+139. *(New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.* 1920.) *Price* 11*s*. 6*d*. *net.*

This work is mainly intended for the use of constructional engineers, architects, and others who have to deal with the protection of iron from rust. The author lays great stress upon the utility of red lead for this purpose, and he rightly points out the importance of the fineness of division of the red-lead particles, so that a most homogeneous paint-coating may be obtained. A great deal of importance is attached to the amount of litharge present, and the author advises the use of a pure red lead because it is found that on keeping as a mixed paint the litharge causes "livering," or if much be present the paint may even set hard; in any case such paints cannot be spread evenly. The exact reasons why pure red lead (Pb_3O_4) should be superior to other pigments as a protective coating for iron are not made clear; the author, as stated, insists upon its fineness, but does not say why any equally fine inert pigment should not do as well. Although the presence of much litharge is condemned, some may be added, if desired, under special circumstances to a 98 per cent. red lead paint. The reviewer is of the opinion that insufficient importance has been attached to the character of the oil binder used for thinning (*cf.* Ingle and Woodmansey, J., 1919, 101T); but the mention of the sand blast as a means of cleaning rusted surfaces either for painting or repainting is a welcome suggestion; it has been used in America for some time, but does not seem to have found sufficient application in Europe. The book is embellished with numerous photographs of bridges, steamers, etc., which seem to serve little useful purpose, but as the volume is written in a popular style, it is suitable for the people for whom it is intended.

HARRY INGLE.

PUBLICATIONS RECEIVED.

THE CASE-HARDENING OF STEEL. *By* H. BREARLEY. *Second edition. Pp.* 207. *(London: Longmans, Green and Co.* 1921.) *Price* 16*s*.

INTERNATIONAL HANDBOOK OF THE WORLD'S CHEMICAL INDUSTRY AND TRADE, 1913–1914—1919–1920. *By* DR. W. A. DYES. *Volume I. Pp.* 1–752. *Edition E. (Wittenberg near Halle: Hopf'sche Verlagsbuchdruckerei Gebr. Jenne, G.m.b.H.* 1921.)

FESTSCHRIFT DER KAISER WILHELM GESELLSCHAFT ZUR FÖRDERUNG DER WISSENSCHAFTEN ZU IHREM ZEHNJÄHRIGEN JUBILAUM. *Pp.* 282. *(Berlin: Julius Sprenger.* 1921.) *Price: paper* 100 *mk., bound* 130 *mk.*

TANNING MATERIALS. *By* A. HARVEY. *Pp.* vi.+182. *(London: Crosby Lockwood and Son.* 1921.) *Price* 15*s*.

THE CHEMICAL EFFECTS OF ALPHA PARTICLES AND ELECTRONS. *By* S. C. LIND. *American Chemical Society. Monograph Series. Pp.* 182. *(New York: The Chemical Catalog Co., Inc.* 1921.)

PERFUMES, ESSENTIAL OILS, AND FRUIT ESSENCES. *By* GEOFFREY MARTIN. *Manuals of Chemical Technology, edited by Geoffrey Martin. Vol. X. Pp.* vii.+138. *(London: Crosby Lockwood and Son.* 1921.) *Price* 12*s*. 6*d*.

FACTORY CHEMISTRY. *By* W. H. HAWKES. *Pp.* 59. *(London: Longmans, Green and Co.* 1921.) *Price* 4*s*. 6*d*.

PNEUMATIC CONVEYING. *By* E. G. PHILLIPS. *Pitman's Technical Primer Series. Pp.* 108. *(London: Sir Isaac Pitman and Sons, Ltd.* 1921.) *Price* 2*s*. 6*d*.

REVIEW OF AGRICULTURAL OPERATIONS IN INDIA, 1919–20. *Pp.* 140. *(Calcutta: Superintendent Government Printing, India.* 1921.) *Price, Rs.* 1-4.

AUSKUNFTSBUCH FUR DIE CHEMISCHE INDUSTRIE. *By* H. BLÜCHER. *Eleventh edition, revised and enlarged. Part I. Pp.* 797. *Part. II. Pp.* 803—1590, *with appendices. (Berlin and Leipzig: Vereinigung Wissenschaftlicher Verleger. W. de Gruyter and Co.* 1921.) *Price, bound,* 35*s*. *each part.*

PUBLICATIONS OF THE UNITED STATES BUREAU OF MINES. *Department of the Interior. (Washington: Government Printing Office.* 1920.):—

STRUCTURE IN PALEOZOIC BITUMINOUS COALS. *By* R. THIESSEN. *Bulletin* 117. *Price* 80 *cents.*

STATE MINING LAWS ON THE USE OF ELECTRICITY IN AND ABOUT COAL MINES. *By* L. C. ILSLEY. *Technical Paper* 271. *Price* 10 *cents.*

PRELIMINARY INVESTIGATIONS OF STORAGE BATTERY LOCOMOTIVES. *By* L. C. ILSLEY *and* H. B. BRUNOT. *Technical Paper* 264. *Price* 10 *cents.*

STENCHES FOR DETECTING LEAKAGE OF BLUE WATER GAS AND NATURAL GAS. *By* S. H. KATZ *and* V. C. ALLISON. *Technical Paper* 267. *Price* 5 *cents.*

CAUSES AND PREVENTION OF FIRES AND EXPLOSIONS IN BITUMINOUS COAL MINES. *By* E. STEIDLE. *Miners' Circular* 21. *Price* 20 *cents.*

TENTH ANNUAL REPORT BY THE DIRECTOR OF THE BUREAU OF MINES FOR THE YEAR ENDED JUNE 30, 1920. *Price* 15 *cents.*

PUBLICATIONS OF THE CANADIAN DEPARTMENT OF MINES. *Mines Branch. (Ottawa: Thomas Mulvey.* 1921.):—

THE PRODUCTION OF COPPER, GOLD, LEAD, NICKEL, SILVER, ZINC, AND OTHER METALS IN CANADA IN 1919. *(No.* 547.)

THE PRODUCTION OF COAL AND COKE IN CANADA IN 1919. *By* J. MCLEISH. *(No.* 548.)

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NO. 1. PROCEEDINGS OF THE FIRST CONFERENCE OF DIRECTORS OF INDUSTRIES. *Price* 1 *rupee.*

NO. 2. PROCEEDINGS OF THE SECOND CONFERENCE OF DIRECTORS OF INDUSTRIES. *Price* 12 *annas.*

PUBLICATIONS OF THE UNITED STATES GEOLOGICAL SURVEY. *(Washington: Government Printing Office.* 1921):—

COKE IN 1918. *By* C. E. LESHER *and* F. G. TRYON.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN CALIFORNIA AND OREGON IN 1919. *By* C. G. YALE.

ZINC IN 1918. *By* C. E. SIEBENTHAL.

THE RELATIVE VALUE OF THE PROTEINS IN NUTRITION.

R. H. A. PLIMMER.

Complete hydrolysis of the protein to its constituent 18 or 20 amino-acids occurs during digestion in animals; the amino-acids circulate in the blood and reach the various organs, which build up new tissue from the units. Animals have been maintained on a diet containing as its protein content a mixture of pure amino-acids in suitable proportions. Biologically, the proteins must therefore be regarded as mixtures of the various amino-acids, digestion and absorption as a re-shuffling of the units. The amino-acids are not convertible into one another, nor capable of being synthesised by the animal organism, with the exception of glycine, which, under certain conditions, can be formed in the body. The different proteins have different compositions, thus, for example, casein contains 16 per cent. of glutamic acid and gliadin 40 per cent. Some proteins are complete, *i.e.*, contain all the amino-acids, others are incomplete and lack certain units. It can thus hardly be expected that proteins should have the same value in nutrition. Some of the amino-acids may be indispensable, others not so essential. There are two main problems to study in nutrition: the formation of new tissue, as in the growth of young animals, and the maintenance of tissue, which undergoes so-called wear and tear, in adult animals. The problem is ultimately to find out the function of each amino-acid in growth and maintenance.

The effect of the absence of certain amino-acids.

The most certain way of studying the problem is to feed animals upon known mixtures of amino-acids, but the practical difficulties are far too great. The amino-acids are not easily prepared, and it is almost impossible to obtain sufficient of each of them to feed an animal, even a mouse, for any length of time. Two other ways are possible:—(a) To feed incomplete proteins and add the missing unit or units; (b) to feed completely hydrolysed proteins, *i.e.*, a mixture of amino-acids from which one or more units have been removed by chemical means.

The first experiment of this kind was made by Willcock and Hopkins in 1906. Zein was chosen as incomplete protein and fed to mice: in one set alone, in another set with the addition of 2 per cent. of its amount of tryptophan. Failure occurred in both sets of animals, but not so rapidly in those on zein and tryptophan. Young mice with zein alone died generally in 16 days; with zein and tryptophan in 30 days. Adult mice without tryptophan lived 27 days, with tryptophan 49 days. The survival period was thus appreciably lengthened by the presence of tryptophan. The failure to live was most probably due to the absence of other units from the zein. Ackroyd and Hopkins repeated the experiment in 1916 by the second method of experimenting which offers better conditions. The animals were fed upon a mixture of the amino-acids from casein. This mixture does not contain tryptophan, since it is destroyed by acid hydrolysis. In the first period tryptophan was added; on the 12th day it was omitted and introduced once more on the 35th day. The animals continued their growth during the first period, declined in weight during the second period, and grew again in the third period when the tryptophan was present.

Osborne and Mendel in America have made numerous experiments with various pure isolated proteins of known amino-acid composition. Their most important results in this connexion were with wheat gliadin; this is a complete protein, but has very little lysine. Adult rats were maintained for long periods on this protein—as long as 500 days—but young rats, though they lived for long periods, failed to grow. The authors therefore regarded lysine as essential for growth. Later, they showed that if they added lysine at definite intervals to the food containing gliadin as sole protein, growth took place with the lysine, but not without it. The minimum amount of lysine necessary to produce normal growth was found to be between 2 and 3 per cent. of the amount of protein in the diet.

The value of lysine for growth was shown in a more practical way by Buckner, Nollau and Kastle. They fed chickens on a poultry farm on diets of high and low lysine content. Their figures and photographs definitely showed more rapid growth on the mixture of high lysine content.

The two other hexone bases—arginine and histidine—are essential units of proteins. As shown by Ackroyd and Hopkins, their removal from the hydrolysed casein mixture leads to loss of weight of the animals; if only one is absent from the food the rate of growth is lessened, so that it appears as if these two units were inter-related. The structural formulæ of these compounds suggest a possibility of the conversion of the one into the other by the wonderful mechanisms of the animal body. These two units were found to give an increase of allantoin in the urine of the animals; thus we know that the purine ring can be synthesised from them. This synthesis by animals has long been suspected, as young birds and animals produce purines on a diet with an almost complete absence of purine compounds.

It is more difficult to arrive at the function of the amino-acids containing aromatic nuclei. Some proteins lack tyrosine, but all contain phenylalanine, which is very difficult to remove from a mixture. Phenylalanine and tyrosine both give rise to homogentisic acid in cases of *alkaptonuria;* phenylalanine may therefore be oxidisable to tyrosine in the body. The almost complete removal of tyrosine from the mixture from casein made no difference to the growth of rats, as shown by Totani. The amount of phenylalanine in the mixture was thus probably sufficient to supply the need for aromatic nuclei. According to Abderhalden, tyrosine cannot be dispensed with.

Cystine is the only unit which contains the element sulphur, though another sulphur-containing compound may be present in proteins. The amount of cystine is not known except in a few cases, but it is estimated from the sulphur content. The need of cystine in the food has been shown most conclusively by experiments with phaseolin, the protein of the navy bean. Slow growth resulted on a diet with the protein alone, but normal growth followed the addition of 2 per cent. of its amount of cystine. Very little sulphur is present in casein. Osborne and Mendel found that less casein was required in a diet if it were augmented with cystine: 15 per cent. casein alone gave normal growth, but 9 per cent. if cystine were added.

It is not possible to test a protein without proline, but arachin with only 1·4 per cent. was tried by Sure. This protein failed to give normal growth even after the addition of extra proline, so that its deficiency must be caused by another missing substance. It is possible that proline and glutamic acid are related units in the molecules of the proteins.

An experiment has also been made to see if the animal organism can introduce an amino group into the molecule of nor-leucine and convert it into lysine. Animals fed upon gliadin and nor-leucine did not grow just as on gliadin alone. The synthesis is thus not possible.

The whole group of simple mono-amino-acids has yet to be tested. They may not all be necessary. In cases of diabetes several can give rise to glucose; their function may be to supply energy through their conversion into sugar. Isoleucine is absent from gelatin, as recently shown by Dakin; this may be another reason for the failure of gelatin in nutrition, which is usually attributed to the absence of tyrosine, cystine and tryptophan.

Comparative nutritive value of proteins.

Few proteins show such marked deficiencies as gelatin, gliadin and zein. The different amounts of the units in complete proteins make little difference to growth if the diet contain *abundance* of protein. Growth is observed on the most varied proteins of animal and plant origin; but if any *restriction* in the amount of protein in the food be made, then the growth is lessened or inhibited. Each complete protein will thus have a definite minimum for growth. Two per cent. lactalbumin gave maintenance, 4·5 per cent. growth; 2 per cent. edestin scarcely gave maintenance, 4·5 per cent. slight growth; with other proteins 2 per cent. led to loss of weight. With a protein content of 4·5 per cent. the best growth was with lactalbumin, followed by edestin; there was no growth with casein unless supplemented with cystine, or with glycinin or squash-seed globulin. An experiment showed that a food with 9 per cent. of lactalbumin was equal to one with 12 per cent. of casein or with 15 per cent. of edestin.

The nutritive value of the proteins of legumes, nuts, etc.

The legumes contain large amounts of protein, and the chemical analysis of the proteins shows no abnormality. The proteins of the pea have been found inadequate by McCollum; it is probably due to lack of cystine, for, as stated above, phaseolin is supplemented by cystine.

The soya-bean protein is of good quality for normal growth, so also are the proteins of the peanut. The latter are peculiar in their high lysine content. The proteins of these foods require cooking so as to make them capable of being digested and assimilated.

The edestin of hemp-seed and cotton-seed is not a perfect protein with its high arginine and glutamic-acid content, but the foodstuff is largely used in America as cattle food. Its poisonous constituent can be removed by steaming or by the hot method of oil extraction.

Nut proteins have a high value on account of the high proportion of hexone bases which they contain. Normal growth has been observed on coconut press-cake, walnut, filbert, pine nut, and other nuts. Experimental work has thus confirmed the assertion of fruitarians of the high value of nuts in nutrition.

The nutritive value of the mixture of proteins in cereals.

Though the gliadin group of proteins of cereals is not adequate as source of protein in the food, it does not follow that the mixture of proteins in the grain is likewise insufficient. Wheat and maize glutenins as sole protein have been found satisfactory for growth, and may compensate for the inefficiency of the gliadins. The whole grain contains also small quantities of an albumin, globulins, and proteose. Particular attention has been paid to the nutritive value of cereals. The results are not altogether consistent; the discrepancies seem to be due to the different basal diets used by the various investigators. The results of McCollum and associates are very contradictory; they believe the inadequacy depends on improper mineral supply. Insufficiency of vitamin supply is a contributory cause. Osborne and Mendel tried not only the whole grain, but also different commercial articles produced by milling, such as wheat flour, bran, embryo. Normal growth followed the use of whole grain, and very little difference was noticed among the various grains.

In all cases animals kept for long periods produced small or no litters of young; their health had thus been impaired. This loss of reproductive power has been observed by all workers if cereals supply the sole protein.

Wheat embryo contains the albumin, and is fully adequate; bran proteins are even of superior value. Wheat flour, pearl barley, and maize meal are not adequate.

The milling process thus removes "good" protein. Wheat flour, etc., does not contain enough total protein, but in the experiments the total was made up by adding gluten. The endosperm of the grain will only furnish protein for maintenance.

Supplements to the proteins of cereals.

Neither men nor animals consume the whole cereal, and as the endosperm does not supply enough protein in quantity or quality, it must be supplemented. The protein ratio of 1:10 needs to be increased up to 1:5. Animal proteins form the best supplements. Lactalbumin was shown by Osborne and Mendel to be the best supplement, but for some peculiar and unaccountable reason other workers do not find this protein so good. Meat, milk, eggs are almost equally efficient, but casein is of less value. In the case of maize meal and milk at least an equal part of skim milk is needed; this gives 30 per cent. of the mixture of proteins as derived from milk. Yeast protein and peanut flour are good supplements. Cottonseed and pea are inferior, whilst products like distillers' grain or vegetable albumin, which is derived from grain, are of little value. The best supplementing proteins are thus those containing the hexone bases, tryptophan, etc. which are low in amount in the cereals.

To produce normal or rapid growth it is possible that it may be more economical to use "good" proteins, which are more expensive than "bad" proteins.

Quality of protein in milk production.

Diet plays a large part in milk production. Quantity and quality of protein are the chief factors. Since neither the animal body nor the mammary gland can synthesise amino-acids, the food must contain sufficient for the manufacture of casein and lactalbumin. Hart and Humphrey have paid some attention to this question. A high milk yield of 27 lb. requires a protein ration 1:4·5; 1:6·7 is necessary for 11 lb.; 1:8·5 is not economical. If the animal is not furnished with sufficient protein it produces milk from its own tissues. Skim milk has an efficiency of 65, against 25 of a mixture of maize and alfalfa. Gluten feed (maize embryo) has 45, flax seed 61, casein 59, milk powder 60. A comparison of clover and alfalfa on the same basal diet showed a superiority of alfalfa for high milk production for 16 weeks. With another basal diet the reverse may be the case. The value will depend on the proportions of the amino-acids in the food and their correspondence to the proportions in the milk proteins. No guide is at present available from the side of chemical analysis. Little is known of the proteins of grasses and green foods. The nearest approach to the proteins of cow's milk are the proteins contained in the milk of other animals. If the milk proteins of all animals are the same in composition, the milk of one animal will be as good as that of another animal, but if not, as is most likely, the best source is the animal's own milk. Cannibalism has been proved to be the best method of feeding dogs. We approach cannibalism in the nursing of the young on mother's milk. Milk contains ultimately the proteins of the mammary gland.

Proteins and pellagra.

The primary cause of the disease pellagra appears to be quality of protein, but at the same time insufficiency of protein together with improper salt supply may play a part.

Pellagra was not recorded in Europe before the introduction of maize into Spain by Columbus. The disease spread to France, Lombardy and eastwards, wherever maize was extensively used for food. Roussel (1866) cured it by good food, and advanced cases have been successfully treated by a generous diet (Lorentz, 1914; Willets, 1915). Goldberger cured and prevented the seasonal appearance of pellagra in lunatic asylums by increasing the meat and milk in the diet, which had previously been very deficient in this respect. Goldberger produced the disease experimentally in a squad of volunteers by a diet consisting of vegetable protein, mainly wheat, maize and rice. On a vegetable diet principally of maize, Chick and Hume produced symptoms in monkeys very like the symptoms of pellagra in man, and a cure was effected in one case by a diet containing better proteins.

Wilson, of Cairo, who investigated the outbreaks of pellagra in Armenian refugee camps at Port Said, found the diet was inadequate in energy supply and protein supply (vegetable). Thomas (1909) tested the comparative values of proteins for man, and found that meat was three times as good as maize. Wilson, calculating from Thomas' figures, determined that the refugees had a casein equivalent of 22 gm. per day. On improving to a casein equivalent of 41 gm. per day no more cases of pellagra occurred. Shortage of protein and quality of protein are thus at the root of the trouble.

IRISH PEAT.*

The Peat Inquiry Committee was established to inquire into and consider the experience already gained in Ireland in respect of the winning, preparation, and use of peat for fuel and for other purposes; to suggest what means shall be taken to ascertain the conditions under which in the most favourably situated localities it can be profitably won, prepared, and used, having regard to the economic conditions of Ireland; and to report to the Fuel Research Board.

Particulars of the quantity of peat produced per annum and of the peat resources of Ireland have been given previously in this Journal (*cf.* J., 1920, 213 R). From the investigations of the Committee it is apparent that if air-dried peat is to be produced at the rate of 300 to 500 tons per day, automatic machines of the Wielandt, Baumann, Persson, Jacobson, or Moore type will have to be used. By using such machines instead of hand-winning, the number of men required will be reduced to one-fourth, although the number of women and children will be slightly increased. It is possible also that a longer season could be worked with peat-machines than without, as the men working the machines can be protected from the weather. Night-work might also be undertaken, as cheap electric light would be available. Machine-cut peat dries more regularly than slane-cut peat, is less affected by rain and recovers more rapidly from its effect. This results in quicker drying and offers the possibility of drying more peat per unit area of drying ground than when hand methods are used; and this would lead to greater economy in collection. Machine-cut peat shrinks more than slane-cut peat, with a resulting increase in density, and hence less volume is required for equal calorific value. The volume for equal calorific value may be reduced from 5½ to 4 or even to 3½ times that of coal. Machine-cut peat, owing to the breaking down of the original structure, has a more uniform distribution of the fibres, is less brittle and is better able to stand handling in transport. Peat-machines can cut for the whole depth of a deep bog, so that a more uniform material is obtained, which is very important for gas-producing or steam-raising. It is estimated that one acre of bog will yield 2600 tons of air-dried peat (25 per cent. water), and hence an output of 100,000 tons would involve the cutting away of about 38 acres per annum. To make provision for about 100 years, such a scheme would require some 3800 acres of bog or 5000 acres of land, allowing 1000 acres for the necessary drying-ground and 200 acres for room for working the peat-machines, transport and stacking. To win mechanically 100,000 tons of air-dried peat and deliver it at a distance not exceeding, say, 3 miles from the bog, would require approximately 130 men and 400 women and children for a season extending from February to the end of September. For the remainder of the year only about 35 men would be required for transport.

The Committee recommended that the State purchase a large bog of at least 10,000 acres, and provide four electrically-operated peat machines of the automatic dredger, macerator and transporter type, together with appliances for collecting, stacking and loading, and narrow-gauge tracks with electric locomotives and wagons. It also advised the erection of an electric power-station of at least 500 kw., using peat fuel and supplying power for the machines and transport. It was recommended that the bog be prepared by main drainage, by local drainage for peat-winning and local drainage for agriculture, and also that the necessary housing be provided for the employees, and office and laboratory accommodation be found. The Fuel Research Board intimated its willingness to direct the work of an experimental peat-station in Ireland and, whilst not committing itself to any definite policy, suggested as a broad programme the purchase by the Government of a suitable bog area, the establishment on that area of an agricultural colony under the control and management of the Irish Department of Agriculture, the establishment of an experimental station on the bog area under the control of a deputy director to be appointed by the Fuel Research Board, and the appointment of an Irish Advisory Committee in connexion with the station. The Board's contribution to such an establishment would be limited to buildings and machinery (£34,000), plus £6000 for contingencies, plus running expenses for 4 years (say £14,000), making a total of £54,000.

An agricultural sub-committee appointed by the Department of Agriculture and Technical Instruction for Ireland reported that an agricultural colony is not, and cannot be, complementary to a scheme for the mechanical winning of peat fuel, and that the reclamation of virgin bog would not be remunerative under the most favourable conditions, although the reclamation of cut-away bog might be remunerative provided (*a*) that the cut-away bog afforded facilities for drainage, (*b*) that a sufficient depth of peat were left by those in charge of the peat-fuel winning operations, and (*c*) that either the stratum underlying the peat residue consisted of suitable mineral matter, such as marl, limestone, gravel or clay with an admixture of sand, or that one or more of these materials were present in close proximity to the cut-away bog.

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* The Winning, Preparation, and Use of Peat in Ireland: Report and other Documents. *Fuel Research Board, Department of Scientific and Industrial Research. H.M. Stationery Office*, 1921. Price 3s. net.

The sub-committee was also very sceptical as to the cost of the bog, the cost of housing the labour, cost of live-stock, implements, and incidental expenditure on roads, fences, etc.

Prof. Pierce Purcell has been appointed Peat Investigation Officer to the Fuel Research Board, and further inquiries and research are proceeding.

SOCIETY OF CHEMICAL INDUSTRY.

ANNUAL MEETING, 1921.

SULPHURIC ACID IN CANADA.

Those who follow the development of Canadian chemical industry, and in particular those who are attending the Annual Meeting in Montreal, will be interested in the following short history of the manufacture of sulphuric acid in the Dominion.

Following the discovery of petroleum in the Ontario peninsula in 1868, plants were erected at Hamilton, Woodstock, London, and Petrolea, Ontario, and realising the economy of producing the acid in close proximity to the oil refineries the Canadian Chemical Manufacturing Co. built the first sulphuric-acid works at London. The plant was initially quite a small one, compared with such plants to-day, and consisted of one sulphur burner of the Blair type, two lead chambers, and a concentrating system of lead pans with about twenty glass bottles which were termed retorts. The point of desired concentration was determined by the appearance of white fumes over the surface of the acid, or by observing the clarification produced after adding a pinch of sawdust. Under this treatment the acid first became black, but on attaining a specific gravity of 1·825 it became transparent. This was indeed a crude and inexact method, but it accorded with the practice of that time. Sicilian sulphur was the raw material employed and the amount of acid produced was from 50 to 60 tons per month. When manufacturing first began the water necessary for the reaction was placed in the bottom of the chambers, and this method was followed for several months before the idea of supplying it as injected steam was introduced. As might be expected this was followed by a much larger yield of acid. Not long after, pyrites was used instead of sulphur. The plant was destroyed by lightning a few years later, and when rebuilt on a larger scale the burners were converted to the sulphur type. In 1887 the factory was burned down, and rebuilt with three lead chambers, each 120×20×18 ft., which were not housed in buildings as their predecessors were. The retort system of concentration, in which breaks were frequent, was superseded and improved by the use of the Faure and Kessler type, and production was increased to about 10 tons per day. The factory was dismantled and removed in 1904.

The second Canadian plant was built in 1870 by an English syndicate which purchased land at Petrolea and London, Ont., sank oil wells, and erected at London an oil-refinery and sulphuric-acid works known as the Ontario Chemical Works. The plant consisted of two small chambers with glass-retort concentration and produced from 35 to 40 tons per month; it was absorbed by the company mentioned above, and in 1888 was dismantled.

In the early 'seventies, when pyrites was discovered within about four miles of Brockville, Ont., the Brockville Chemical Co. erected a plant of four chambers, but before actual manufacturing began the buildings were blown down by an unprecedented wind. After being rebuilt the plant worked successfully for a few years, but its career came to an abrupt end owing to the pyrites deposits becoming exhausted.

The Nichols Chemical Co. built a large plant at Capleton, Quebec, about the year 1887, and in 1895 the Victoria Chemical Co. established a plant at Victoria, British Columbia, which is still in existence, and produces acid of 60° B. In 1901 the Dominion Iron and Steel Co., then known as the Dominion Coal Co., started a small plant at Sydney, Nova Scotia, which was replaced by a larger one in 1911. In 1906 the chamber system of the Nichols Chemical Co. at Capleton, Que., was replaced by the contact system. Other contact plants were established by the same company at Sulphide, Ont., in 1907 and at Barnet, British Columbia, in 1909. These are the only contact plants in operation in Canada at the present time. In 1911 the Graselli Chemical Co. erected a chamber plant at Hamilton, Ont., which concentrates the acid to 66° B. by the cascade system. In 1912 the Algoma Steel Corporation, of Sault St. Marie, Ont., erected a Faulding high-chamber plant to manufacture sufficient acid to sulphate the ammonia in its coke-oven gas. This plant is also still operating. Other acid plants of more recent date include that of the Consolidated Mining and Smelting Co., at Trail, British Columbia, built in 1916, and during the war the Aetna Chemical Co. erected a chamber plant at Drummondville, Que., which may be dismantled. The Chemical Products, Ltd., has a plant at Trenton, Ont., which was taken over from the British Chemical Co. after the war and now specialises in the production of acid phosphate.

NEWS FROM THE SECTIONS.

SHAWINIGAN FALLS.

On May 25 Dr. G. S. Whitby, assistant professor of chemistry, McGill University, gave an address on Rubber to the members of this Section.

At the outset the lecturer drew attention to the rapid growth of the rubber-plantation industry during the decade 1909–19, the total production of raw rubber having increased about sixfold, and that of plantation rubber from approximately 3000 to 300,000 tons per annum. Methods of preparing plantation rubber were outlined. Special attention was drawn to the important influence on vulcanisation of the small amount—about 5 per cent. in all—of non-caoutchouc substances present in the raw rubber, the influence of the resin being particularly marked when the rubber is compounded with litharge. Reference was made to the investigations now being conducted at McGill University on the chemical nature of the rubber "resins."

With the aid of lantern slides, the processes employed in the making-up and vulcanisation of rubber articles were outlined. The influence of the chief compounding ingredients was considered, the growing importance of organic accelerators of vulcanisation being emphasised. Data were given showing that such accelerators may not only increase the speed of vulcanisation, but that they may also confer improved physical properties on the vulcanisates; and further, that different accelerators may exercise favourable effects in different directions, *e.g.*, one may improve tenacity whilst another improves extensibility. Mention was made of the work of Wiegand on the influence of inorganic compounding ingredients.

The uniqueness of the mechanical properties of vulcanised rubber was brought out by consideration of the stress-strain curve, of the magnitude and character of hysteresis and elastic after-effects in rubber, and of the relation between thermal and tensile effects. Experiments illustrating these effects were shown.

LONDON.

At the meeting held on June 6, Mr. J. L. Baker presiding, a paper entitled "Industrial Respirators," by Dr. L. Levy and D. W. West, was read by the former.

A respirator consists essentially of two parts: a face-piece and an absorption apparatus. The face-piece may consist only of a mouthpiece and nose-clip, but this form causes much discomfort and affords no protection to the eyes. The second and more recent form is a complete mask of rubber fabric with eyepieces of "Triplex" glass so arranged that the incoming air passes over the inner surface of the glass, thus preventing dimming by moisture from the breath. This form requires neither the use of a mouthpiece nor of a nose-clip, and may be worn for a much longer period than the former type. The purifying canister is of the form used in the small military box-form respirators, and the substances employed for absorption should have a high capacity and rate of reactivity for the gases to be removed from the inspired air. The absorbents used vary according to the toxic substance to be dealt with; crystallised copper sulphate, highly activated charcoal, and a mixture of alkali and charcoal powder are used, respectively, for ammonia, hydrocarbon and other neutral gases, and acid gases. A satisfactory means of removing smoke and solid particles is a mask of fine felt fitted with an efficient non-return valve for the egress of the expired air. No absorbent for carbon monoxide is known which is suitable for use in a respirator, and, therefore, the catalytic oxidation of this gas by oxides is employed. But this method has certain disadvantages, *e.g.*, the harmful effect of moisture upon the catalyst (which may be overcome by a preliminary passage of the gases through calcium chloride), the absorption of a portion of the atmospheric oxygen to oxidise the carbon monoxide, and the absence of any indication of failure in the respirator. The last-named defect may be remedied by using an upper layer of iodine pentoxide and sulphuric acid which, when any carbon monoxide unoxidised by the catalyst is absorbed, liberates free iodine vapour that acts upon the throat of the wearer and thus indicates the breakdown of the purifying medium. The tests used in determining the efficiency of different forms of respirator were described.

Professor K. G. Naik then read a paper on "The Gold and Silver Thread Industry of India," which prior to the war had become nearly extinct owing to the dumping of German-made material upon the Indian markets. During the war this source of supply was cut off and the native industry resuscitated. Most of the work is done by hand—the little machinery that is employed is of a primitive kind. Silver bars, 9 in. long by 3 in. square, are coated with 0·5—1·0 per cent. of gold by hammering, and the bars are further hammered out to a length of thirty inches. The resulting rods are then pulled through a series of draw-plates until each ounce is converted into a fine wire some 2000 to 4000 ft. long. After polishing on a pad of leather or cloth, the wire is flattened into ribbon by passing between rollers, and is then wound into a helix upon a rotating needle, or wound spirally around cotton or silk threads. Spangles are produced by cutting the helix lengthwise and beating the rings so obtained with a special kind of hammer. A method devised by the author for plating the fine silver wire by electro-deposition in a gold-cyanide bath was described, and lantern slides of various stages in the manufacture as well as numerous samples of the different products were exhibited.

MEETINGS OF OTHER SOCIETIES.

THE PHYSICAL SOCIETY.

At the meeting held on June 10, Sir Ernest Rutherford lectured on "The Stability of Atoms."

The study of the scattering due to α particles has led to the view that the atom consists of a minute positively-charged nucleus surrounded by a number of rings of negatively-charged electrons. A direct verification of Moseley's law (the nuclear charge is represented by the atomic or ordinal number of the atom), to an accuracy of about 1 per cent., has recently been given by Chadwick for the elements copper, silver, and platinum. The atomic radius of the atom of a heavy element such as uranium (ordinal number 92) is of the order 10^{-8} cm., and the corresponding nuclear radius is 7×10^{-12} cm.; in the case of lighter elements, such as helium, the nuclear radius is about 3×10^{-13} cm. The only promising line of attack whereby a permanent effect may be produced upon the atomic structure of an element appears to be that afforded by the impact of swiftly moving α particles with the atomic nucleus; no permanent effect upon the atomic structure is to be anticipated from effects produced in the rings of negatively-charged electrons. The great stability of the atomic structure arises from the minute dimensions of the nucleus, and the manner in which the nucleus is guarded by the rings of electrons. It is, however, possible by the bombardment of swiftly moving α particles to effect an occasional collision of the particle with the atomic nucleus of an element, more especially a gas, and in this manner, the lecturer has shown that in the bombardment of nitrogen, hydrogen is apparently ejected from the nucleus. The nature of the ejected particle is ascertained from its range of ejection. Recently the method has been extended to the heavier elements such as aluminium, and the surprising result has been obtained that in such cases and also in the case of nitrogen, particles are ejected having a range greater than 80 cm., the range of ejection of the hydrogen particle being 28 cm. The possibility of the ejected particles being due to contamination with hydrogen is definitely ruled out by the method of experiment. Thus the possibility of attacking the nucleus has been advanced a stage, and the lecturer concluded by remarking that the recent work of Shimizu has shown that the nucleus would be very readily disintegrated, with the liberation of prodigious atomic energy, provided the α particle were able to approach sufficiently near the atomic nucleus.

THE ROYAL INSTITUTION.

Sir J. J. Thomson delivered the Friday Evening Discourse on June 17 on "Chemical Combination and the Structure of the Molecule." After a brief review of the electron theory, the lecturer outlined his theory of atomic structure. In this it is assumed that the force between the central positively charged nucleus of the atom and the electrons is not in accordance with the inverse square law, but assumes a series of periodic attractive and repulsive values as the distance apart increases. Eight is then the greatest number of electrons that can be in stable equilibrium without reproducing electronic distributions characteristic of atoms containing fewer electrons, a result in accordance with the Periodic Law. It was pointed out that the periodicity of atomic sizes as deduced from this theory was in accord with the results of the experiments of Bragg but differed somewhat from the periodicity as exhibited in Lothar Meyer's table. The theory indicates the possibility of the formation of compounds of the inert gases. Chemical combination between two atoms is supposed to occur as the result of the coalescence of the cellular structures of electrons and positive nucleus constituting the atoms. This coalescence may be effected in more than one way. A ready explanation is thus afforded of the existence of, *e.g.*, a combination of carbon and oxygen both as carbon monoxide and as the radicle=CO. The arrangement of eight electrons at the corners of a cube with a positively charged nucleus at the centre constitutes an essentially stable system. Such cubes can be combined geometrically in a variety of ways of which two were instanced by the lecturer. In the first, the cubes are combined so as to have a face in common, and in the second a side is common to them. Analysis shows that the second is the more stable arrangement, and in this manner is explained the existence of the very extensive series of carbon chain compounds of the generic formula $(CH_2)_n$, compounds of this type being known up to the value $n=60$. The series formed by cubical structures having a face in common is a very restricted one and is known only up to C_3H_4. The benzene ring contains thirty electrons, each carbon atom containing four and each hydrogen atom one. To constitute such a ring from six cubical structures of eight electrons requires eighteen electrons to be held in common. Clearly this can be effected by constituting the structure of six cubes having alternately a face and a side respectively in common. Such a mode of constitution affords an explanation of the existence of alternate single and double bonds between successive carbon atoms in the benzene-ring structure. In this connexion it was pointed out that theory led to the conclusion that the equilibrium figure of eight electrons about a central positive nucleus was not a cube but what might be termed a "twisted cube" formed by twisting one face through half a right angle relative to the opposite and parallel face about an axis perpendicular to the faces. A symmetrical benzene-ring structure would result from the coalescence of *triangular* faces of six such twisted cubes, whereby the economy of eighteen electrons in the structure would be effected in a uniform manner.

At the conclusion of the lecture, the Duke of Northumberland, president of the Institution, presented on behalf of the members a gold loving cup to Sir James and Lady Dewar on the occasion of their golden wedding.

THE ROYAL SOCIETY.

At the meeting held on June 16, a paper entitled "The Ratio of the Specific Heats of Air and of Carbon Dioxide," by Prof. J. R. Partington, was communicated by Dr. J. A. Harker.

The ratio of the specific heats, $\gamma=c_p/c_v$, was determined by the method of adiabatic expansion. The gas was contained in a 120-litre vessel, and the temperature-change immediately after expansion followed by a platinum thermometer, with compensating leads of wire 0·001 mm. diameter, the resistance of which was observed by an Einthoven string galvanometer of 0·01 seconds period. The fundamental temperature measurements were made with a mercury thermometer. The results were calculated by the characteristic equation of D. Berthelot, so that deviations from the ideal gaseous state were allowed for. The final results, which are believed to be accurate to 1 part in 1000, are: γ for air at 17° C.=1·4034; γ for carbon dioxide at 17° C.=1·3022. From these numbers the specific heats of the gases were calculated by Berthelot's equation, with the following results: c_p for air at 17° C.=0·2387 cal.; c_p for carbon dioxide at 17° C.=0·1996 cal. All the values refer to atmospheric pressure.

SOCIETY OF GLASS TECHNOLOGY.

The last meeting of the session 1920–21 was held in the University of Sheffield on June 15, Dr. Morris W. Travers presiding. Dr. P. G. H. Boswell, professor of geology in the University of Liverpool, was elected the first honorary member of the Society.

A discussion was then held on "Oil-firing in the Glass Industry." The president showed by means of thermochemical calculations that the fuel efficiency of a furnace in which the oil was burned with air at the ordinary temperature, and that of a furnace in which coal was first gasified by air with only little steam, the gas being burned with air at the ordinary temperature, were practically identical. That non-regenerative glass tanks fired with oil were preferred to those fired by gas was probably due to the fact that small gas-fired tanks were inefficient. In oil-firing practically the whole of the air could be preheated, but in gas-firing only the secondary air could be preheated, so that a regenerative oil-fired furnace was more efficient than a furnace in which the secondary air was preheated. Other conditions being equal, the ratio of the efficiency of the oil and gasified-coal systems was as 1·37 to 1. Neglecting other factors, the results might be summed up as follows:—

	Net calorific value.	Cost in London per ton.	Efficiency of combustion.	Relative cost.
Oil ..	.. 10,500 ..	105s. ..	1·37 ..	1·20
Coal ..	.. 7,420 ..	45s. ..	1 ..	1

Mr. J. Connolly remarked that he had run an oil glass-furnace for four years, which had worked with fewer breakdowns and stoppages than any other method. At the end of that period, however, the price of oil was raised and its use was abandoned. The adaptability of oil to glass work had been demonstrated and was past argument, but he did not think they would get a higher efficiency with oil than with coal so long as there was a great difference in price.

Mr. J. H. Steele thought that oil had not been given a fair chance in the glass industry; his experience of it was very satisfactory. It was unusual, however, to find a glass furnace properly adapted to oil-consumption. He had known better results to be obtained from the use of crude oil or creosote than from fine petroleum of high calorific value, a fact which indicated that the furnaces in use were not satisfactory.

Mr. F. G. Clark spoke of the use of "glory holes" fired by oil. The best results were obtained from crude creosote oil, partially heated, and compressed air at about 15 to 20 lb. per sq. in. In making 8-ounce bottles on a 7½ hour shift some 3·92 gallons of oil were used, at a cost of 4s. 3d. per shift. When two chairs were working at one "glory hole," the cost was about 2s. 2d. per shift. Gas did not yield the temperature desired, and creosote oil gave a fuller and "fatter" flame than petroleum. Consequently the neck of the bottle was heated up more uniformly and the product had a better "finish."

Mr. G. Lawton described a simple oil-burner that had yielded good results. In one power-station one ton of oil was apparently equivalent to about 2½ tons of coal.

Mr. J. Venn Stevens pointed out the advantages of oil-fuel for glass furnaces. It was clean in use, the flame came into direct contact with the glass without producing any discoloration or deterioration, and a uniform temperature could be maintained.

Mr. A. Bayliss remarked that the "Aquitania" had in the stoke-hole 350 men when fired with coal, but only 84 with oil-fuel. With solid fuel the efficiency might range from 50—65 per cent., but with oil-fuel it might be as high as 85 per cent. In addition, ignition and extinction were instantaneous. The freedom from sulphur in the gases formed by combustion was an important point for glass workers.

Mr. W. H. Casmey referred to the very great potentialities of oil when mixed with inferior qualities of solid fuel. In one case, by taking 3 tons of coke breeze (at 12s. 6d. per ton, calorific value 10,000 B.Th.U.) and one ton of oil-fuel, a fuel of 12,000 B.Th.U. was obtained costing 37s. 4d. per ton, capable of giving an evaporation of 530 lb. per 1s., or nearly 2000 lb. more evaporation per ton than with coal at 40s. per ton.

Mr. W. J. Rees thought it was very necessary to obtain reliable data showing how efficient coal-firing compared with efficient oil-firing.

Prof. W. E. S. Turner exhibited and explained a diagram showing the proposed design of a combustion-chamber for the oil-firing of a glass tank furnace. He also read a communication from a firm in which it was stated that there were very few oil-fired pot furnaces in this country. The few that had been tried had not been entirely successful, the chief trouble being the cracking of pots. This was due to excess of heat in one particular place on the pot, causing unequal expansion. A method of avoiding this was suggested.

BRITISH PHARMACEUTICAL CONFERENCE.

The fifty-eighth annual meeting of the British Pharmaceutical Conference was held at Scarborough from June 13 to June 16 inclusive, under the presidency of Major E. Saville Peck, of Cambridge.

In his presidential address Major Peck demonstrated the need for higher education. Pharmacy, if it is to progress, must move forward with the advance of general education and of applied science, and if it is to take up its position with other professions it must bring its final qualifications up to University and Continental standards. He advocated the institution of a fellowship examination which would entitle the holder to call himself a clinical analyst or clinical pharmacist, or registered clinical assistant of the Pharmaceutical Society, and urged the inclusion of practical physiological chemistry and bacteriology (including chemical microscopy) among the compulsory subjects. In British pharmacy to-day there is need of a closer union of purpose, counsel, and activity of all those who are working for a full realisation of the profession.

Among the papers communicated to the Science Section was one on "The Determination of Formaldehyde and Paraformaldehyde in Tablets," in which Messrs. Norman Evers and C. M. Caines described a method based on a comparison of the colour produced by the addition of Schiff's reagent to a solution of a tablet containing formaldehyde, with that produced by the same reagent on a standard solution of formaldehyde of known concentration. The accuracy of the estimation by the authors' method is not influenced by the presence of menthol, milk sugar, or cane sugar usually present in the tablets.

In a paper on "The Titration of Certain Alkaloids" Mr. Norman Evers showed that bromophenol blue is the most suitable indicator to use in the titration of morphine, atropine, and the neutral salts of quinine, but for an acid salt of quinine, methyl red is preferable. A method for the titration of ammoniated quinine for the combined determination of quinine and ammonia was described.

Mr. A. J. Jones read a paper on "The Quantitative Determination of Minute Quantities of Bromide in Saline Residues, and in a Mixture of the Halogens." The author advocates the use of a method which is a development of Denigès' process. The method is applicable when dealing with quantities of about 0·1 mg. of bromide existing alone or in admixture with iodide and chloride in water residues, or the residue from the ignition of any organic substance.

In a paper on "The Determination of Nitrates in Bismuth Salts by means of Titanous Chloride and Devarda's Alloy," Mr. T. McLachlan showed that the British Pharmacopœia method for the estimation of nitrates in bismuth carbonate is unreliable. The method for estimating the nitrate by reducing with titanous chloride, distilling with steam the ammonia formed, collecting in acid, and titrating back, was found tedious, but satisfactory results were obtained by using Devarda's alloy in alkaline solution in the presence of a small amount of alcohol. The author's method can be used for estimating the amount of nitrate in any bismuth salt excepting those in which ammonia is present.

In a paper on "The Determination of Small Quantities of Phosphate in Glycerophosphates," Mr. J. L. Lizius referred to the need on the biochemical side for a simple, rapid and accurate method for the estimation of small quantities of phosphoric acid, and on the analytical side to the need of a method for estimating small amounts of phosphate, present as impurities in glycerophosphates. The author's method is a tintometric one based upon a comparison of the colour obtained by adding nitric acid and ammonium molybdate to a standard solution of phosphoric acid and to a solution of the glycerophosphate under examination.

Mr. E. C. Davies communicated details of a process devised for "The Assay of Colchicum by means of Phosphotungstic Acid." Phosphotungstic acid precipitates colchicine in a bulky form in a 1·5 per cent. solution of sulphuric acid. The author's method may be summarised as follows:—The drug having been exhausted with alcohol, and the alcohol recovered, the colchicine is taken up with water, shaken out with chloroform, again taken up with hot water, precipitated as phosphotungstate, from which the colchicine is liberated either by chloroform and alcohol, or by chloroform, alkali and alcohol. The special advantages of the method described is that the alkaloid is obtained in a greater degree of purity than by other processes.

Messrs. C. E. Corfield and G. R. Boyes, in their paper "An Examination of Commercial Bismuth Phenate," showed that some samples of the salt contained little or no phenol. They suggested a method of preparation yielding a product containing 14·76 per cent. of phenol, this being the maximum content which it was found possible to obtain.

The following papers were also communicated to the meeting:—"The Ether-solubility of Scammony Resin"; "The Analysis of Theobromine Sodium Salicylate"; "A Note on Liquefied Carbolic Acid"; "The Quantitative Determination of Sodium Arsenate"; "The Assay of Atropine and Cocaine in the B.P. Ointments"; "The Approximate Estimation of Commercial Cresol in Lysol"; "A Contribution to the Study of Digitalis"; "A Note on the Official Method for the Determination of Hydrocyanic Acid"; "The Nature and Composition of Irish Moss Mucilage"; "The Action of Heat and Moisture on the Activity of Ergot and Liquid Extract of Ergot"; "An Investigation of some of the Factors which may determine the Keeping Qualities of Infundibular Extract"; "The Volumetric Determination of Arsenic Acid and Arsenates."

At the closing session of the Conference, Prof. H. G. Greenish, professor of pharmaceutics at the Pharmaceutical Society's School of Pharmacy, was elected president of the Conference for the ensuing year, and an invitation was accepted from the Nottingham Pharmaceutical Association to hold the annual meeting of the Conference at Nottingham in 1922.

PERSONALIA.

The University of Wales is to confer the honorary degree of Doctor of Science upon Sir J. J. Dobbie.

Dr. Eric K. Rideal has been appointed to the Humphrey Owen Jones lectureship in physical chemistry at Cambridge University.

Prof. S. P. L. Sörensen of the Carlsberg Laboratory, Copenhagen, has been awarded the Leblanc Medal of the Société Chimique de France.

The degree of Doctor of Science of the University of Manchester is to be conferred upon Messrs. F. W. Atack, Colin Campbell, and R. G. Fargher.

Dr. W. J. Jones, senior lecturer in chemistry in the University of Manchester, has been appointed to the chair of chemistry in University College, Cardiff.

Prof. J. von Braun, of Berlin, who was recently appointed director of the Chemical Institute in Frankfurt, has been called to the chair of chemistry in the University of Vienna.

Dr. C. F. Chandler, who was president of this Society in 1899—1900, and Dr. William H. Nichols, president in 1904—1905, have been elected honorary members of the American Chemical Society.

Dr. E. W. Washburn, head of the ceramic department of the University of Illinois, has been appointed editor of the *Journal of the American Ceramic Society* in succession to Mr. H. F. Staley.

The Nichols Medal, which is presented annually for the best original paper published in any of the journals of the American Chemical Society, has been awarded for 1920 to Dr. Gilbert N. Lewis for the paper on "The Third Law of Thermodynamics and the Entropy of Solutions and of Liquids," by himself and Mr. G. E. Gibson.

Dr. Robert Robinson has been appointed to succeed Prof. J. C. Irvine as professor of chemistry and director of the chemical research laboratory in the University of St. Andrews. Dr. Robinson was for several years professor of organic chemistry at Liverpool University and in 1920 was appointed director of research to the British Dyestuffs Corporation, Huddersfield.

We regret to record the death on June 21, at the age of eighty, of Mr. David Brown, late senior partner of J. F. Macfarlan and Co., manufacturing chemists, Edinburgh, and an original member of this Society.

The late Mr. William J. Chrystal, chemical manufacturer, of Shawfield Works, Rutherglen, and an original member of this Society, bequeathed £10,000 each to the University and the Royal Technical College, Glasgow.

The death is announced of Dr. F. P. Dewey, head chemist of the Mint Bureau, Treasury Dept., Washington, D.C., who joined this Society in 1889; also of Ambrose Monel, at the age of 47, the inventor of "Monel" metal. Monel was a graduate of Columbia University and became the first president of the International Nickel Co. in 1902, at the age of twenty-nine.

Dr. Ludwig Knorr, professor of chemistry in the University of Jena, who died on June 4 in his 62nd year, is perhaps best known for his discovery of antipyrin and for his researches in the pyrazole group, but his work on the constitution of morphine, on new methods of synthesising amino-alcohols, quinoline and pyrrole, and his investigations on keto-enol equilibrium will long be remembered as outstanding achievements in the sphere of organic chemistry.

NEWS AND NOTES.

UNITED STATES.

The Bureau of Mines Cryogenic Laboratory.—The new Cryogenic Laboratory of the U.S. Bureau of Mines was opened by Madame Curie on the occasion of her recent visit to Washington. The main work of the laboratory will be to obtain fundamental scientific data, especially such as will enable the Government plants to produce helium more efficiently and at lower cost. Its second and subsidiary object is to provide facilities for a limited number of American scientists who wish to carry out special low-temperature investigations, particularly along lines not covered by the work of the technical staff of the Bureau of Mines. The laboratory is directed by Dr. R. B. Moore, chief chemist to the Bureau of Mines.—(*Chem. and Met. Eng., May* 25, 1921.)

Sugar Consumption in 1920.—According to statistics published in the *American Sugar Bulletin*, the consumption of refined sugar in the United States in 1920 was 4,075,173 tons, as against 4,126,673 t. in 1919, the *per capita* consumption in the two years being 86·35 and 87·45 lb., respectively. Of the total sugar consumed, the United States produced 144,000 t. cane, 900,000 t. beet, and 20,000 t. of other sugars. A feature of the imports was the large supply obtained from Java and other countries that pay full tariff rates, rendered necessary by the heavy consumption of home-produced sugar in the autumn of 1919 and the decrease in the Cuban crop of 1919–20. There was a decrease of 268,106 t. in the exports (roughly 400,000 t.), so that a larger amount became available for home consumption. Stocks in hand on January 1, 1921, were 1,093,545 t., the stocks of domestic cane and beet, and imported sugar being 715,862 t. greater than in 1919. This stock is about equal to the old crop of Cuban sugar still held in Cuba, and is therefore by no means excessive (*cf.* J., 1921, 173 R). —(*Ind., Tr. J., May* 20, 1921.)

Cadmium in 1920.—Further progress is reported in the output of cadmium in the United States, the production in 1920, 129,283 lb. of metal, valued at $151,261, being nearly 30 per cent. greater than in 1919. The production of cadmium sulphide amounted to 32,133 lb., valued at $37,133, as against 31,197 lb. in 1919. Since 1910 the American production has steadily increased, and Germany, with a production of 85,395 lb. in 1919, now takes second place. The metal has not been imported into the United States since 1915, but about 40,000 lb. was exported in 1918, chiefly to France (*cf.* J., 1920, 437 R). A comparatively new use for cadmium is in making small-arms ammunition; a cadmium band on the hard-jacketed cartridge ball takes the rifling with little wear on the barrel, and thus prolongs the life of the gun. Electroplating with cadmium offers promise of expansion, and as the metal is a better rust-preventive than nickel, it might replace nickel for this purpose were there less difference in price. It is suggested that as cadmium tarnishes more readily than nickel the latter metal might be deposited on a first coat of cadmium. A commercial process for electroplating iron and steel articles has been developed by the Udylite Process Co., Kokomo, Ind. The pigment industry offers a good prospective field for the consumption of cadmium compounds, chiefly cadmium yellows and "cadmium lithopone."—(*U.S. Geol. Surv., May* 12, 1921.)

Bromine Production in 1920.—According to a preliminary report of the U.S. Geological Survey, the output of bromine in 1920 was 518·1 long tons, valued at $745,381, a decrease of 37 per cent. in quantity and nearly 40 per cent. in value compared with 1919. The production, however, was greater than in any year prior to 1918 (*cf.* J., 1921, 173 R). The average price per lb. received by the producers rose from 13 cents. in 1910 to $1.31 in 1916 and was 64 cents. in 1920, which is more than three times the average price in 1913.—(*Official.*)

FRANCE.

Industrial Notes.—*Chemical Industry.*—Owing to the continuance of the trade depression, more factories are closing down, the latest being those of the Société Normande de Produits Chimiques. The situation, however, is held to be merely temporary, and preparations are being made for an economic revival. Thus the Compagnie Nationale de Matières Colorantes et de Produits Chimiques is organising the production of dyes at its factory at Villero-Saint-Paul, north of Creil. The factory covers an area of 111 acres, and is divided into three groups; the first has been producing indigo for some time; the second has just started to manufacture alizarin; and the third is preparing to produce indanthrene. It is anticipated that the output of these three products and their derivatives will not only cover home requirements, but leave a surplus for exportation; and it appears that an outlet has already been found in China. More than 75 chemists are employed and, apart from the existing works laboratories, a large central research laboratory is to be established this year. The company has allocated 250,000 francs for the furtherance of research in the chief technical universities. The Claude synthetic-ammonia process is likely to be established shortly in the Landes district of south-west France, where coal, electric-power, and salt are available. It is intended to produce ammonium chloride for fertilising purposes.

Metallurgy.—The export of ferrous scrap is now free and the 20 per cent. *ad valorem* duty has also been abolished. Stocks of iron ores are considerable, and in a few mining areas extraction has been stopped. Some producers still hold fairly large supplies of pig iron, but the stocks of others are entirely depleted. The price of hæmatite pig iron has been fixed at 450 fr. per metric ton as from June 1, which represents a reduction of 85 fr. on the price at April 1 last. Production of steel has been reduced and stocks, especially of heavy steel, do not find a ready market.

Coal.—Great activity prevails at the chief mining centres, as demand is reviving owing to depletion of stocks consequent on the continued export of coal to England. Thus the stocks of the East, State, and North railways are 50 per cent. lower than in April. The mines devastated during the war produced 392,045 t. in April or 27,750 t. more than in March.

Power and Transport.—The Senate has approved a scheme to utilise the Rhine for the production of 800,000 h.-p., for making it navigable over a distance of 500 km. and enabling irrigation to be applied to an area of 494,000 acres. The cost is estimated at 3000 million fr., and the annual revenue to accrue to the State at 300 million fr.

The railway system in Algeria is to be extended during the present year in order to open up the various mining areas that have been discovered in recent years; about 1539 million fr. will be spent on new construction and on repairing existing lines.

Clove Production in Madagascar.—Practically all the cloves exported from Madagascar are produced on the island of St. Marie, off the north-east coast, only some 10 to 15 metric tons being grown on the mainland. The exports, mainly directed to France, were 143 t. in 1918 and 499 t. in 1919; the 1920–21 crop amounted to only 20 t., although 87 t. was exported in December, 1920. The outlook for the 1921–22 crop is stated to be good.—(*U.S. Com. Rep., Apr.* 23, *May* 7, 1921.)

The Graphite Situation in Madagascar.—According to a statement published by the Madagascar Service of Mines, the production of graphite in Madagascar in 1920 was between 4000—5000 metric tons (1919, 4000—5000 t.; 1918, 16,000 t.; 1917, 35,000 t.). Exports during the year amounted to 14,919 t., of which 4449 t. went to England, 2127 t. to the United States, 51 t. to Belgium, and the remainder to France. Stocks at the end of the year were about 24,000—25,000 t., nine-tenths of which consisted of flake and one-tenth of amorphous carbon. Three-quarters of the flake graphite in stock averaged 80—90 per cent. carbon, the tendency now being to turn out a quality averaging 90 per cent. and above owing to the small demand. About 20 per cent. of the production is treated mechanically, some half-dozen plants being equipped with drying and separating machinery (*cf.* J., 1921, 110 R).—(*Bd. of Trade J., May* 26, 1921.)

SOUTH AFRICA.

Eucalyptus Bark as a Cork Substitute.—A correspondent writing in the *South African Journal of Industries* of March-April, 1921, draws attention to the value of the thick bark of the gum tree (*Eucalyptus sideroxylon*) as an insulating medium for refrigeration plants. A test carried out by Messrs. Sykes and Co., Ltd., of Johannesburg, showed that the insulating property of eucalyptus bark, when kept dry, was about equal to that of granulated cork, the actual figure obtained being 1·32 B.Th.U. per sq. ft. per degree difference in temperature per 24 hrs., using insulation 6 in. thick. As the bark is at present a waste product, the suggested new use should be worth consideration.

AUSTRALIA.

Industrial Notes.—The Hoskins Iron and Steel Co., Ltd., which owns large iron and steel works at Lithgow N.S.W., has purchased 380 acres of land at Port Kembla, near Wollongong, N.S.W., as a site for additional steel works. The estimated expenditure is approximately £2,000,000, and it is intended to purchase as much as possible of the plant and equipment in the United Kingdom.

Mr. A. Gibson, who is now exploring Papua (New Guinea), has applied to the Australian Government for a concession to exploit the nipa palm in the Fly River District. He guarantees a production of 500 tons of paper pulp per week and 3 million galls. of motor spirit per annum, and is reported to be willing to expend £300,000 on the erection of a plant and to employ 60 whites and 1500 natives.—(*Official.*)

JAPAN.

The Dye and Colour Industry.—The trade depression has affected the Japanese dye industry so adversely that at the beginning of this year only the larger and well-established factories remained in operation, and even these are now in a difficult position owing to growing German competition both abroad and at home. Nevertheless considerable progress has been made in the production of the chemicals required in dyemaking. Caustic soda and alkali of good quality are produced in fair amounts; acetic acid, acetone, nitric acid, ammonia, and glycerin are being made; nitrogen fixation and the production of soda ash have yet to be undertaken. The expectation of the *ad valorem* duty (35 per cent.) on all imported dyes was the cause of an abnormal increase in imports during 1920, so that the market became overstocked. The proposal to amalgamate the dye factories met with opposition and was not consummated. It is reported that the Japanese Government intends to stimulate dye-production by assisting the Japan Dye Manufacturing Co., which was floated at the beginning of the war. The progress made by the Japanese dye industry is shown by the following statistics of imports in 1913 and 1919:—

	1913. lb.		1919. lb.
Indigo, natural	27,650	..	1,930,812
Indigo, synthetic	2,203,969	..	521,316
Logwood extract	963,624	..	1,846,605
Alizarin	212,661	..	—
Aniline	9,816,613	..	4,364,880
Coal-tar dyes, other	—	..	114,985
Ultramarine blue	324,980	..	183,960
Prussian blue	87,662	..	—
Cobalt oxide	40,489	..	114,414
Liquid gold, silver and platinum..	59,897	..	2,133

Of a total import of 13,737,545 lb. of dyes in 1913, over 80 per cent. came from Germany, but in 1919, out of a total of 5,943,371 lb., the United States supplied 83 per cent.; in 1920, the origin of the 4,479,863 lb. of coal-tar dyes imported was as follows:—United States 67, Germany 17, United Kingdom 6, and Fance 4 per cent. During 1920 Japan exported 5,595,140 lb. of coal-tar dyes, but it is not known whether they were made in the country or transhipped (*cf.* J., 1921, 32 R).—(*U.S. Com. Rep., Apr.* 30, 1921.)

GENERAL.

A New Colour Index.—The last edition of "Farbstofftabellen" by Dr. Gustav Schultz, published in 1914, has become out of date owing to the great changes in the colour industry brought about by the war, and for some time past those interested in the production and application of dyes have felt the need of a new book dealing concisely with the constitution and properties of the whole range of colouring matters. The Council of the Society of Dyers and Colourists has, therefore, now decided to publish a Colour Index to supply this want, and Dr. F. M. Rowe has been appointed to edit it. In order to ensure accuracy and to include the maximum amount of available information, the Society of Dyers and Colourists has invited colour manufacturers throughout the world to co-operate in this publication by supplying the trade names, constitution, and properties of all known dyes of technical importance, and the proofs of the book will be checked by an expert revising committee representing every section of colour production and use. All references to patent and scientific literature will be brought up to date and checked in order to eliminate the errors which are to be found in previous reference books of this type. The Colour Index will be published in twelve parts, and every effort will be made to issue the first part within six months.

The Coal-tar Colour Industry in Italy.—When the manufacture of coal-tar colours in Italy was started in 1915, considerable difficulties were encountered owing to the lack of technical experience and the need for economising fuel and employing Italian raw materials as far as possible. Production commenced with the colours most in request and which could be manufactured most easily, viz., Sulphur, Azo, and triphenylmethane dyes. These three groups constitute roughly 60–70 per cent. of the Italian consumption, which prior to the war amounted to 6500 metric tons per annum (Sulphur dyes 1500 t., Azo dyes 3000 t.). The present output of 1300–1400 t. of Sulphur dyes and 2500 t. of Azo dyes is not so inadequate as has been affirmed. The criticism that fast cotton colours and vat dyes, like indigo and indanthrene, are not produced is held to be unwarranted, as the demand is too small. However, it has been announced that these colours are now to be manufactured by the Italica and Bonelli companies. At present the industry is passing through a crisis which, apart from the general trade situation, is accentuated by the total lack of protective duties and by the fact that German reparation colours (*cf.* J., 1920, 438R) are being sold in Italy at prices lower than those of similar goods imported privately from Germany. If such obstacles were removed the Italian dyestuff industry would make much greater progress.—(*Giorn. Chim. Ind. ed App., Apr.*, 1921.)

The Camphor Industry.—The Japanese camphor monopoly and the remarkable growth of celluloid manufacture in Japan, together with the correlated decrease in the exportable surplus of camphor, have stimulated the search for new sources of supply and for substitutes in the manufacture of celluloid. There is little chance of an increased supply from Japan as the hope of obtaining the product by distilling the leaves has been disappointed, and although the camphor from the young trees is said to be unsatisfactory, the maintenance of the Japanese output implies the cutting of trees less than 35 years old, whereas the highest yield is not obtained until the trees are 60 years old. American buyers are looking to China for new supplies, as there is an immense number of camphor trees in the Shan States of South-West Yunnan. In Fukien the remaining trees are more or less inaccessible, but experimental production from wild and planted trees is being carried out in the island of Hainan. A Chinese authority has suggested that a foreign syndicate should start operations in South Hainan and South Kiangsi, and extend them later to Kweichow, Kwangtung, and Kwangsi. In the United States, where camphor production began in 1904, the Celluloid Co. now has 3000 acres planted at Satsuma, the Arlington Co. 12,000 acres at Waller, and planting has also been carried out in Texas and in the San Joaquin Valley, California; the yield approximates 120 to 150 lb. of camphor per acre. As the Philippines offer prospects of successful cultivation, an American company has acquired there the control of a large area of suitable land. The camphor tree has been grown more or less successfully in Madagascar, the Canary Islands, Buenos Ayres, and Algeria, but it is to be feared that the true species *Cinnamomum camphora* is sometimes confused with the less camphoraceous *C. glanduliferum*. Within the British Empire, in addition to the Federated Malay States, Ceylon, and Mauritius, the species grows well in Burma, the Nilgiris, Dehra Dun, at Amani in Tanganyika, and in Queensland; experiments in South Africa suggest that the tree might be profitably cultivated in some of the warmer and moister parts of the Union. It is clear that the camphor tree can be grown successfully within the British Empire, and if care be taken to secure the true species, the small but constant yield of camphor obtained by distilling the leaves would be amply remunerative, even at prices below those now obtaining.

Hitherto synthetic camphor has been unable to compete with the natural product. The so-called "artificial camphor" differs widely from the true camphor and consists of pinene hydrochloride, prepared by treating turpentine oil with dry hydrogen chloride, but true synthetic camphor is made by oxidising borneol or isoborneol prepared from pinene hydrochloride or hydrobromide. The synthetic product closely resembles true camphor, but is usually optically inactive and often contains small amounts of borneol and other substances. As camphor can be manufactured in Formosa at an export price of 6d. per lb., this constitutes the limit to the cost of its production elsewhere. It is stated that 36 gallons of turpentine is required for 98 lb. of camphor, and this, with turpentine at 46s. per cwt., implies a cost of about 1s. 4d. per lb. of camphor for turpentine alone. Efforts should be made to obtain supplies within the British Empire by cultivating the tree in suitable areas and by manufacturing the synthetic product in the United Kingdom (*cf.* J., 1920, 76, 149, 185, 236, 306, 331, 379, 381 R, 1921, 148 R).—(*Imp. Inst. Bull. XVIII*, 4).

A New Process for the Cold Vulcanisation of Rubber.—G. Bruni has devised a new process for the cold vulcanisation of rubber which is based upon the formation in the nascent state of thiocarbanilide, or other substituted thio-ureas, within the mass of the rubber by the interaction of carbon bisulphide on aniline in presence of zinc oxide or other metallic oxides.—(*G. Chim. Ind. ed App., May*, 1921.)

Synthetic Nitrogenous Fertilisers in Germany.—The recent addition of 700 million marks to the capitalisation of the chief German dye companies (*cf.* J., 1921, 174 R) promises well for the future of the nitrogen-fixation industry, since all the associated firms have expressed their intention to allocate a considerable proportion of the new capital to the development of the nitrogen works. Prior to the war the annual production of nitrogen was about 100,000 metric tons, derived from gas and coke-oven installations; to-day these undertakings supply only a small proportion of the total output (gas works about 5 per cent.). In a recent review of the subject, Dr. Bueb, managing director of the Nitrogen Syndicate, stated that the annual production of cyanamide was limited to about 100,000 tons (fixed nitrogen), that the maximum annual output capacity of the synthetic ammonia plants was at present about 300,000 t., and that of the gas and coke-oven plants about 100,000 t.; total 500,000 t. of fixed nitrogen. The days of the use of Chile saltpetre in German agriculture are clearly numbered. Whereas in 1913, 770,000 t. was imported, the imports in 1920 were at the rate of only 40,000 t. per annum (Jan.—Oct. 31,284 t.). This reduced importation meant a clear saving to the German people of over 2000 million marks at the current rate of exchange. It is worthy of note that agriculturists have at last become convinced that sulphate of ammonia is the equal of Chilean nitrate in fertilising value. A good deal of ammonium nitrate is now being used, the difficulties due to its hygroscopic nature having been overcome; but the future seems to lie with synthetic urea, on account of its very high nitrogen content, its harmlessness when applied too heavily, and its good keeping qualities; large-scale experiments with it are now being conducted in Bavaria, and results should be available by the end of the year. Hopes are entertained that heavy dressings of nitrogenous fertilisers will help to revive the fallen sugar-beet industry and bring new life to the pastures. Prof. Neubauer, of Bonn, has shown the remarkable value of such heavy applications: within 4 weeks 65 per cent. of the nitrogen applied was converted into vegetable albumin, and if such results can be achieved on the large scale a pasture will be able to support twice as much livestock as hitherto. In order to promote intensive cultivation with nitrogenous fertilisers, the Nitrogen Syndicate has formed a subsidiary company with a capital of 500 million mk. to advance loans to consumers. Dr. Bueb is not in favour of utilising water-power in the nitrogen industry, except in a few of the cyanamide works, as the supply is small and far too fluctuating.

The Vegetable Oil Industry in Argentina.—The production of linseed oil in Argentina is sufficient to meet the requirements of domestic paint manufacturers and those in neighbouring countries, but the chief consuming countries usually prefer to import the seed for extraction in their own mills. Now, however, a Dutch company, the Cia. Sud Americana de Cereales, is erecting an oil mill near Rosario which, it is stated, will be the largest grinding plant in the world. Castor oil for industrial and medicinal use is produced in appreciable quantities, but rapeseed, colewort, and maize oils are only made in small amounts. The supply of cottonseed oil, which is produced on a small scale by most of the existing plants, will probably be augmented as a result of the increased acreage planted to cotton in the El Chaco territory; a new mill especially adapted for cottonseed-oil production is being built. Cottonseed and groundnut oils are both growing in importance as they are used as substitutes for imported edible oils. Olives have been grown experimentally in the province of La Rioja, but the extension of this crop is not likely to be very rapid. Vertical hydraulic presses are usually employed to express the oil, but extraction with benzine or trichlorethylene is used in a few plants; the mechanical equipment of the mills is said to be good.—(*U.S. Com. Rep., Mar.* 21, 1921.)

Cinchona Cultivation in the Philippine Islands.—According to the Director of the Philippine Bureau of Science, large areas in Luzon and Mindanao Islands are well adapted for cinchona cultivation, judging from the success obtained with a small plantation in Baguio under the supervision of the Bureau of Forestry. The climatic and general conditions in the Philippines are very similar to those in Java and India, where 90 per cent. and 10 per cent. respectively of the world's output are produced.—(*U.S. Com. Rep., May* 18, 1921.)

The Italian Mineral Industry.—Italy requires normally from 10 to 11 million tons of coal annually, but since the armistice only about 600,000 t. has been imported, largely owing to decreased supplies from Great Britain. Little can be expected from the coal deposits at Heraclea in Asia Minor (*cf.* J., 1920, 442 R), now under Italian control, not only on account of political unrest and lack of transport facilities, but because of the inferior quality of the coal. It appears that Italy will have to depend on imported fuel for some time to come, as the development of hydro-electric power on a large scale is impossible because of the great cost of erecting power stations and transmission lines. Italy produces a negligible amount of mineral oil, and the lignite is of poor quality, although it can be used to a limited extent when briquetted with powdered coal. Sufficient iron ore occurs in the island of Elba and at Cogne in the Val d'Aosta to supply the existing blast furnaces, but the production of pig iron by no means meets the demand; in 1919, 239,710 metric tons of pig iron was produced and 223,811 t. imported. An extension of electric smelting to other ores is feasible, and this would help to free the metallurgical industries from dependence upon imported fuel. Italy is a very important producer of mercury (*cf.* J., 1920, 204 R), especially since the accession of the Idrian mines; certain financial interests have considered the formation of a syndicate to sell the output of the Italian and Spanish mines, thereby ensuring control of the European market. For some time past the Italian sulphur industry has been declining from its former leading position, mainly through competition from the United States, labour difficulties, high costs of production, and inability to improve the output owing to the excessive subdivision of the mines into small holdings. Italy is still the leading producer of pumice, which is obtained chiefly from the volcanic island of Lipari, and nearly all of which is exported to the United States. A large proportion of the output of talc is exported, but of late both production and exports have fallen off. The output of zinc ore, which prior to the war exceeded 150,000 metric tons yearly and was nearly all exported, has fallen off by over 50 per cent. since 1914. Production of zinc metal is very small —1282 t. in 1919—and imports amount to less than 20,000 t. The output of lead ore has declined steadily from 44,654 t. in 1913 to 32,130 t. in 1919, and that of lead metal from 21,674 t. to 16,530 t. There are five producing copper mines, which in 1919 supplied 16,653 t. of ore, compared with 83,302 t. in 1918 and 89,487 t. in 1913; 1243 t. of metal was produced and 79,425 t. imported. The following table shows that production of aluminium has been steadily increasing but is still insufficient to supply the entire home demand:—

	Production.	Imports.		Production.	Imports.
	Metric tons.			Metric tons.	
1913	874	483	1917	1,740	3,996
1914	937	312	1918	1,715	5,008
1915	904	1,665	1919	1,673	1,602
1916	1,126	2,132			

The demand for asphalt or asphalt products is not large and the home production, largely concentrated in Sicily, almost satisfies requirements.

Provisional figures for 1920 of the mineral production in Italy, including the new provinces of Trentino and Venezia Guilia, are as follows:—

	Metric tons.
Iron ore and ferro-manganese	423,300
Manganese ore	29,140
Copper ore	6,360
Lead ore	36,325
Zinc ore	93,090
Silver	500
Antimony	125
Iron and copper pyrites	322,450
Mercury	1,325
Fuel:—	
Lignite	1,662,430
Anthracite	28,600
Coal (triassic)	120,715
Bituminous shale	22 000
Shale (ichthyolitic)	495
Sulphur, raw and ground	293,000
Petroleum	4,750
Asphalt and bituminous rock	108,600
Bauxite	37,960
Graphite	4,190

—(*U.S. Com. Rep., Mar.* 2, 14, 1921.)

LEGAL INTELLIGENCE.

ALLEGED INFRINGEMENT OF GERMAN SULPHUR-BLACK DYE PATENT. *A.-G. für Anilin Fabrikation in Berlin* v. *Levinstein, Ltd.*

With reference to the above case, of which a short report appeared in our last issue (p. 220 R), a correspondent writes that the decision that the use of sodium dinitrophenolate with sodium sulphide and sulphur is a different process from the use of dinitrophenol with sodium sulphide and sulphur will appear surprising to chemists, but the Court was obviously and, in his opinion, rightly impressed by the evidence that the plaintiffs—the patentees—in their own manufacture used sodium dinitrophenolate and kept it as "a factory secret of considerable importance." Two passages from the judgment are worthy of reproduction:—

"The plaintiffs themselves from the first manufactured their dye by using the sodium salt and not the dinitrophenol; the manufacture started soon after the date of the patent (1900), but when precisely does not appear. We regard this fact as one of very great importance. Dr. Liebmann, who was one of the principal witnesses for the plaintiffs, says that in 1913 he was for the first time told that the black dyes in question could be made from sodium dinitrophenolate, and that the plaintiffs were in fact making their dye in this way. (See evidence given in camera, page 67, question 2807 and following). He obviously regarded this as a matter of considerable importance, and as one which the plaintiffs would desire to keep to themselves."

Further:—

"We come the more readily to the conclusion that the plaintiffs and their advisers did not know that it was possible to obtain their dye by the substitution of the sodium dinitrophenolate for dinitrophenol because, if they did know it, it is difficult to understand why such possibility was not pointed out in the specification. We think it is clear on the evidence that for commercial purposes the substitution in question was economically an advantage and accordingly, by omitting to mention it, they were, on the assumption that they knew the facts, laying the patent open to attack on the ground that the patentees had not informed the public of the best way known to them of putting the invention in practice."

It is important to understand that this is not a decision that when the use of an acid is patented working with the salt is not an infringement. Another point of first-rate importance for chemical patentees is the distinction drawn by the Court between this case and the Half-Watt Lamp case, The British Thomson-Houston Co., Ltd., *v.* Corona Lamp Works, Ltd. (*cf.* J., 1918, 117 R).

"The remaining objection to the patent is that of insufficiency of description. Practically it resolves itself into this, that the patentees leave undefined the limits within which variation of proportions is permissible. The answer to this objection, we think, is this, that the proportions are not an essential part of the description. The patentee gives an example, by following which the result can be obtained. The possibility of varying the proportions without effecting the result is merely mentioned as one of the points in which the patented process differs from Cassella's. Under such circumstances we see no objection in point of law to a specification which, while giving a definite prescription, leaves the proportions which a particular operator may employ to his own discretion, informed possibly by actual experiment. The case here is not like that of the British Thomson-Houston Company, Ltd. *v.* Corona Lamp Works, Ltd. (Reports of Patent Cases, 37, p. 227), recently before this Court; there the larger diameter of the filament was of the essence of the invention and, this being so, it was held that the specification was insufficient because the patentee did not state what he regarded as a large diameter. For these reasons we agree with Mr. Justice Sargant that the objections to the validity of the patent fail."

This part of the judgment, our correspondent thinks, will make it a much-quoted case.

PARLIAMENTARY NEWS.

HOUSE OF COMMONS.

British Dyestuffs Corporation, Ltd.

Answering Sir W. Barton, Sir R. Horne said that the Government holding in the British Dyestuffs Corporation consisted of 850,000 £1 preferred ordinary and 850,000 £1 preferred shares, both fully paid; at current market quotations, these shares would be worth about £580,000, but in view of the present trade depression this figure afforded no adequate indication of the ultimate value of the investment. Recent changes in organisation indicated that whilst substantial progress had been made, the board was not entirely satisfied with the position. The Government directors were in full accord with their colleagues as to the necessity of taking every possible measure to secure greater efficiency in the conduct of the undertaking, and steps had been taken to that end.—(June 9.)

Lead Paints.

Mr. Hannon asked if the recent experience of the Office of Works had shown that leadless paints were neither as economical in use nor as durable as lead paints, and whether any report had been prepared by H.M. Office of Works on the relative economic value of lead paints and leadless paints. In reply, Lieut.-Col. Sir J. Gilmour stated that the experience of the Office of Works with leadless paints was being carefully reviewed for the information of the Home Office and in connexion with the general question of the prohibition of the use of lead paints which was to be discussed at the International Labour Conference in October.—(June 13.)

Dyestuffs Development Committee.

Capt. Elliott asked the President of the Board of Trade whether an application had been received from the British Association of Chemists, as representing technical chemists engaged in the industries making and using dyestuffs, for representation on the Development Committee to be set up under the Dyestuffs (Import) Regulation Act, 1920. In reply, Mr. Baldwin said that the application had been received, and although the object was to secure a fully representative committee this did not imply the appointment of a representative of each individual association. Satisfactory progress had been made in the constitution of the committee and an announcement would be made at an early date.—(June 20.)

Imports from European Countries.

Replying to Capt. Coote, Mr. Baldwin stated that the imports of pig iron and steel from Europe into the United Kingdom during 1920 were valued at £11,853,528 and included;—Pig iron, 177,202 tons; ingots, not special steel, 7427 t.; blooms, billets, slabs, steel, not special steel, 54,480 t.; special steels, 310 t.; the total imports of all descriptions of iron and steel and manufactures thereof were 467,432 t., worth £11,853,528; and the total value of all imports, except food and drink, into the United Kingdom from Germany was £28,319,000.

In an answer to Sir W. Barton, Sir P. Lloyd-Greame said the imports from Germany during the period January—March, 1921, included the following items:—Finished coal-tar dyes, other than alizarin and synthetic indigo, £472,104; crude zinc, £338,925; wire, other than uninsulated electric and fencing wire, £156,278; machines and machinery, not specified, £129,588.—(June 20, 21.)

The British Cellulose Co.

Lord H. Cavendish-Bentinck asked the Chancellor of the Exchequer whether he was aware that the British Cellulose Co. had stated in its prospectus that the company's plant was capable of turning out a large quantity of artificial silk, although at the time of issue of the prospectus the promoters of the company had not discovered the process of making an artificial silk which would dye; and if the Government was responsible for the issue of this prospectus. In reply, Mr. Young said that the Chancellor of the Exchequer was advised that the silk produced by the company had always been capable of taking dyes The Government was not responsible for the issue of the prospectus, but merely approved the reference in it to the Government's acceptance of preference shares.—(June 21.)

H.M. Factory Gretna.

Sir L. Worthington-Evans, in reply to Major W. Murray, stated that the Government had decided to dispose of the factory at Gretna.—(June 21.)

Duty on Spirits.

Mr. Young, replying to Major Kelley, said that an amendment was moved to the Finance Bill last year to the effect that spirits used in the manufacture of perfumes and similar substances should be treated similarly to spirits used in medicinal preparations or for scientific purposes. The amendment was withdrawn and he saw no reason to modify the decision then taken.—(June 21.)

REPORTS.

MINES AND QUARRIES: GENERAL REPORT, WITH STATISTICS, 1920. *By the* CHIEF INSPECTOR OF MINES. PT. I.—DIVISIONAL STATISTICS. *Pp.* 27. *London: H.M. Stationery Office.* 1921. *Price 3d.*

The number of mines operated in 1920 was 2851 under the Coal Mines Act, and 498 under the Metalliferous Mines Act, compared with 2843 and 495, respectively, in the previous year. In addition, there were 5479 quarries at work (5135 in 1919), making a grand total of 8828 mines and quarries, or 355 more than in 1919. The total number of workers employed in or at the mines and quarries was 1,337,297, of which 93·3 per cent. was employed under the Coal Mines Act, compared with 1,270,050 and 93·8 per cent. in the preceding twelve months. There were 1184 deaths from accidents, and the accident death-rate under the Coal Mines Act was 0·88 per 1000, as against 1229 and 0·94 per thousand in 1919. The appended table summarises the output of minerals from all sources in the United Kingdom during 1920:—

Summary of output of minerals from mines, quarries and brine wells.

	Tons. 1919.	Tons. 1920.
Alum shale	5,539	4,848
Arsenic	1,997	2,527
Arsenical pyrites	1,178	75
Barium compounds	64,150	60,087
Bauxite	11,020	9,221
Bog ore	2,179	3,045
Chalk	3,747,165	2,629,406
Chert, flint, &c.	84,303	50,082
Chromite of iron	1,100	150
Clays* and shale	11,030,418	7,765,965
Coal	229,532,081	229,779,517
Copper ore and copper precipitate	275	372
Fluor spar	54,683	36,860
Gold ore	1	—
Gravel and sand	2,757,052	2,048,427
Gypsum	286,978	220,003
Igneous rocks	5,620,691	4,387,703
Iron ore	12,707,475	12,254,195
Iron pyrites	6,659	7,336
Lead ore	15,399	13,868
Lignite	150	—
Limestone (other than chalk)	11,227,817	9,537,495
Manganese ore	12,875	12,078
Natural gas (cb. ft.)	(95,000)	(90,000)
Ochre, umber, &c.	14,957	10,547
Oil shale	2,842,582	2,763,875
Rock salt	108,083	90,938
Salt from brine	2,050,287	1,817,142
Sandstone	2,183,816	1,699,853
Slate	215,269	164,098
Soapstone	361	688
Sulphate of strontia	4,183	1,872
Tin ore (dressed)	4,858	5,156
Tungsten ores	94	166
Uranium ore	60	—
Zinc ore	5,064	6,933
Total	284,600,799	275,384,528

* Including china clay, china stone and mica clay.

REPORT ON THE COMMERCIAL AND INDUSTRIAL SITUATION OF SWEDEN AT THE END OF 1920. *By* H. KERSHAW, *Commercial Secretary to H.M. Legation, Stockholm. Pp.* 40. *Department of Overseas Trade. London: H.M. Stationery Office.* 1921. *Price* 1s.

Among the many difficulties with which Swedish industries had to contend during 1920 were severe competition from Germany, high cost of production partly due to the high price of coal, high wages, the 48-hour week, and strikes. Increased protection was solicited by the iron and steel, glass, and certain other industries, but the Government authorities decided against any general rise in customs duties and import prohibitions, although these were recommended for adoption in certain isolated cases. The timber industry was prosperous, and the year was a very profitable one for paper and pulp manufacturers, the exports comprising 585,000 tons, dry weight, of bleached and unbleached sulphite pulp (561,325 t. in 1919); 141,000 t. of bleached and unbleached sulphate pulp (119,074 t.); and 281,965 t. of mechanical pulp, wet and dry (207,712 t.). By the end of the year large stocks had accumulated, the European demand had fallen off but that from the United States had increased, and generally, prospects were uncertain. Output in the iron and steel industry was considerably below the average of the previous ten years owing, it is suggested, to labour troubles, but the export trade was good. At the date of the report the industry was in a difficult position and clamouring for protection. Exports of iron ore amounted to 3,736,000 metric tons, compared with 2,419,000 t. in 1919 and 6,440,000 t. in 1913 (a record year). The Lapland ore, unlike the ore in Central Sweden, is high in phosphorus, but the supply is practically inexhaustible; it is exported chiefly to Germany. Conditions in the chemical industry were fairly good until the summer, and then became steadily worse; glass manufacture is being hit by Belgian competition, but production in the match industry is gradually returning to the pre-war level. A law has been passed prohibiting the use of yellow phosphorus in the manufacture of matches. The high price of coal has led to serious consideration of the country's water-power resources, the estimated supply of water power during about nine months in the year being 6,750,000 h.-p. The total production of electric energy at the State power-stations in 1920 was 740 million kw.-hrs., compared with 685 millions in 1919. Rapid progress has been made in the electrochemical industry, which now exports considerable quantities of calcium carbide, nitrolim, chlorates, perchlorates, sodium sulphate, chloride of lime, and electrometallurgical products such as iron and steel, ferrosilicon, ferromanganese, zinc and lead.

The import and export returns for 1920 include the following items:—

Imports.

	1920. Metric tons.	Inc. or dec. over 1919. Per cent.
Sugar, all kinds	60,425	+540·3
Hides and skins, undressed	11,912	− 1·7
Mineral oils	189,730	+ 16·7
Coal tar	11,367	+ 18·5
Vegetable oils and fats	17,690	− 57·4
Linseed	27,555	+ 56·1
Oilcake	64,356	− 6·2
Vegetable tanning materials, extracts	3,589	− 72·3
Zinc white, lithopone, barytes (white)	5,311	+102·7
Salt, domestic	26,843	+ 87·4
Sodium sulphate and bisulphate	50,337	+273·6
Soda and sodium bicarbonate	18,783	+ 32·1
Chile saltpetre	23,048,584	− 0·7
Calcium nitrate	22,302	+301·3
Phosphates, crude	112,853	+ 62·8
Stassfurt salts	49,508	− 60·4
Pyrites	114,600	+ 60·7
Coal	2,806,303	+ 45·5
Coke	358,259	+ 28·4
Briquettes	16,973	+ 2·5
Iron and steel	212,878	+ 71·3
Copper, crude	18,178	+ 24·2

Exports.

Pulp, wood :—		
Mechanical, wet	214,210	+ 34·9
Mechanical, dry	57,755	+ 14·0
Sulphite cellulose, bleached	44,162	+ 54·1
Sulphite cellulose, unbleached, wet	40,733	+ 61·1
Sulphite cellulose, unbleached, dry	511,859	− 1·9
Sulphate cellulose	140,548	+ 18·0
Cardboard, paper, etc.	284,999	+ 15·7
Cement	08,131	+ 83·2
Superphosphates	42,376	+279·7
Matches, wooden	36,450	+ 28·2
Iron and steel (includ. manufactures)	222,678	+ 8·7

The writer of the report draws attention to the great loss incurred by British manufacturers in carrying on their Swedish business through agencies established in other Scandinavian countries.

COMPANY NEWS.

BRUNNER, MOND AND CO., LTD.

In his speech to the annual general meeting, held at Liverpool on June 15, Mr. Roscoe Brunner (chairman of directors) said that the new company —Synthetic Ammonia and Nitrates, Ltd.—had erected at the works of Castner Kellner a semi-large scale plant of the Haber type, but with improvements, and this had been running for some weeks producing about 1 ton of ammonia per day, soon to be increased to 2 tons. The plant, which was the most complicated the company had erected, was designed and started with exceptionally few troubles, and the experience gained would render much easier the designing and operating of the large plant to be erected at Billingham. The technical results obtained confirmed the expectation that with any reasonable cost of construction and any probable selling price, the business would be a profitable one.

Referring to the present industrial depression, Mr. Roscoe Brunner said that trade had suffered the severest slump it had ever known and that recovery must necessarily be slow. The wealth destroyed in the war could only be replaced by hard work and saving, and to save the people must be able to buy in greater quantities at a lesser cost. Costs must be reduced by lowering wages, since in the cost of production of every article wages is by far the largest item, averaging at least 70 per cent. The reductions in wages had not gone nearly far enough. Salaries, too, must be reduced, and the Government must lead the way in economising; every Government service which is not of vital necessity must be scrapped. When the new capital was issued in April, it was intended to continue the erection of the Wallerscote Works and the Synthetic Ammonia Works at Billingham, but owing to the incidence of the coal strike and the uncertainty of the immediate future, the company's building programme had been postponed in its entirety.

The gross trading profit for the year ended March 31 last was £493,165, after deducting depreciation, compared with £826,000 in the previous year, but investment revenue increased from £460,000 to £655,479, and the net profit was £936,000, as against £1,126,000. The decrease in the total dividend on the ordinary shares from 11¼ to 8 per cent. is partly due to the increased capitalisation and partly to the severe depression which set in last November.

ZINC CORPORATION, LTD.

The annual general meeting, held in London on June 15, was addressed by Mr. F. A. Govett, chairman and managing director.

With present working costs, working hours, and metal prices, the company's mine cannot be worked at a profit, and operations are now confined to producing zinc concentrates from the accumulated tailings (664,633 t.) and middlings (28,862 t.), of which the supply should last about 2½ years, and from which the profit at current prices would cover the dividend on the preference shares. No development work is being done and the ore reserves at the close of the year 1920, exclusive of the zinc lode, were estimated at 2,115,700 tons of ore, averaging 14·6 per cent. lead, 2·6 oz. silver, and 9·4 per cent. zinc. The company has subscribed a further £50,000 to the Electrolytic Zinc Co., has invested £15,000 in a combine called the British-Australian Lead Manufacturers, to make subsidiary lead products, and has acquired an interest in another combine—the Broken Hill Globe Timber Co.—to ensure a supply of timber. The prosperity of the company, said Mr. Govett, depends upon the cost of producing lead and zinc concentrates, and the price of lead and spelter; the former is practically entirely a question of the cost of labour, and the latter mainly one of the world's consumption and demand, which depend upon price and hence upon cost of production, *i.e.*, labour. The cost of labour is thus the vital factor throughout. For 19 months the company's mine at Broken Hill was closed down owing to a strike of labour, and when work was resumed in November on the terms of an award, it was found that those terms made profitable mining impossible, except with lead at an abnormally high price. If the 35-hour week prescribed by the award were abandoned for the 44-hour week, mining could be profitably carried on with lead at a considerably lower price.

The profit for the year ended December 31, 1920, was £34,409, out of which the preference dividend was paid for the first half-year (10 per cent.), but owing to the uncertain outlook no distribution has been made for the second half-year.

TRADE NOTES.

BRITISH.

Nigeria in 1919.—The year 1919 was marked by a revival in trade owing to the demand for oil-bearing materials, particularly palm oil, palm kernels, and groundnuts. Trade, however, was hampered by the inability of the railway to deal with all the produce. Cotton is quickly regaining its pre-war importance and the cocoa industry is developing steadily, the export in 1919, 25,511 tons, being five times greater than in 1914. Cultivation of rubber and of kola are being encouraged. In the Northern Provinces 88 tin-mining companies worked throughout the year and produced 8168 t. of tin ore (8434 t. in 1918). Gold mining was continued near Minna, in the Nupe Province, and 319 oz. of alluvial gold was won. The output of coal was 137,844 t. compared with 148,214 t. in 1918, the reduction being due to labour difficulties.

The total value of the imports during 1919, exclusive of specie, was £10,798,671, as against £7,423,158 in 1918. The British Empire supplied over 96 per cent. of the total imports, which included:—Kola nuts, 162,701 centals; salt, 54,755 tons; kerosene, 2,069,353 galls.; iron, steel, and manufactures of, 9972 t.; soap, 3016 t. Exports were valued at £14,675,789, exclusive of specie (£9,511,971 in 1918); they included:—Benneseed, 57,074 t.; rubber, 892,081 lb.; shea products, 1729 t.; tin ore, 7685 t.; palm oil 100,967 t.; palm kernels, 216,913 t.; groundnuts, 39,334 t.; hides and skins, £1,262,140. Eighty-five per cent. of the exports was directed to the British Empire, but both import trade and export trade with the United States have increased.—(*Col. Rep.–Ann., No.* 1064, *Mar.*, 1921.)

FOREIGN.

Foreign Company News.—*Czechoslovakia.*—The following companies have recently been formed for the manufacture of artificial silk:—Gebrüder Baader, Mahrisch-Ostrau, capital 20 million mk., with a daily output capacity of 1000 kg.; Elberfelder Glanzstoff-fabriken, Aussig, capital 50 million mk.; Th. Liebig, Reichenberg, capital 20 million mk.; Wolf and Schleim, Jos and Löwenstein and the Zivno Bank, Theresienthal near Arnau, capital 40 million mk.—(*Chem. Ind., May* 30, 1921.)

France.—The Etablissements Kuhlmann is paying a dividend of 12 per cent., the same as last year; the carry forward is 992,496 fr.

The Société d'Electro-Chimie et d'Electro-Métallurgie announces a net profit of 3,709,493 fr., and a dividend of 45 fr.

A net profit of 17,323,657 fr. was made by the Société Saint-Gobain in 1920; 7 million fr. was carried to reserve and the dividend payable is 245 fr. per share (210 fr. for 1919).—(*Rev. Prod. Chim., June* 15, 1921.)

Germany.—Kalle and Co., A.-G., Biebrich, made a net profit of 3,030,000 mk. in 1920 and is paying 20 per cent. The dyestuffs produced by the company fetched good prices and the pharmaceutical section developed satisfactorily, but during the second half of the year sales decreased owing to foreign competition and the industrial crisis.

The net profit of the Vereinigte Kunstseidefabriken, A.-G., Frankfurt, for 1920 was 270,426 mk., the dividend is 9 per cent., and the capital is being raised to 8 million mk. The manufacture of staple fibre was found to be unremunerative and that of artificial silk was resumed in the middle of the year.

A dividend of 25 per cent., plus a bonus of 500 mk., making a total of 75 per cent., is to be distributed by the A.-G. für Chemische Industrie, Gelsenkirchen; 1,140,000 mk. was written off and 2 million mk. carried to maintenance account, leaving a net profit of 5,800,000 mk.

The turnover of the Chemische Fabrik auf Aktien vorm. E. Schering, Berlin, increased considerably, but early in the year production did not meet demand owing to lack of fuel and other difficulties. The net profit was 3,592,381 mk. and the total dividend 25 per cent.; the capital is to be raised to 11 million mk. to extend and modernise the works at Eberswalde.

The output of the Chemische Fabriken vorm. Weiler-ter-Meer, Uerdingen, in 1920 was less than one-half of the pre-war average, but owing to good prices in the first months the results for the year were favourable. Wages and salaries rose from 5,560,000 mk. in 1919 to 18,100,000 mk. in 1920, the number of employees remaining about the same. The balance to the credit of profit and loss was 7,133,367 mk. and dividends amounting to 18·5 per cent. have been paid or are payable.

Other dividend announcements are as follows:—Köln Rottweil A.-G., 16 per cent. (capital 66 mill. mk., to be raised to 100 mill. mk.); Dynamit A.-G. vorm. Alfred Nobel and Co., 16 per cent. (capital 72 mill. mk., to be raised to 100 mill. mk.); Rheinische-Westfälische Sprengstoff A.-G., 12·8 per cent. (capital 26 mill. mk., to be raised to 40 mill. mk.); Siegener Dynamit Fabrik, 12·8 per cent. (capital 1·2 mill. mk., to be raised to 1·8 mill. mk.). The Farbenfabriken vorm. F. Bayer and Co., Leverkusen, is paying 20 per cent. for the year and the capital is to be raised to 430 million mk.—(*Chem. Ind., May* 23, 30, 1921.)

Poland.—A new company, the Polish Oil Co. "Polpetrol" has been formed with a capital of 60 million Polish marks. With the help of British and French capital it has acquired 490 acres of oilfields in the Sanok district, where eight wells have been sunk, and is about to purchase an additional 1162 acres upon which six shafts will be constructed during this year. The "Galician Joint-stock Oil Industry Co." is another new oil company, with a subscribed capital of 16,250,000 mk (Polish mk.=1s. at par, now about 0·04d.).—(*U.S. Com. Rep., Apr.* 15, 1921.)

Spain.—The Industrial Resinera Ruth company has been formed by a German firm and the Sociedad Union Resinera Española, the latter subscribing 70 per cent. of the capital. The company will manufacture enamels, varnishes, paints, glue, aniline, and other chemical products, including synthetic camphor.—(*U.S. Com. Rep., Apr.* 15, 1921.)

Yugoslavia.—The Kastel Factory of Chemical and Pharmaceutical Products, recently founded at Karlovatz, Croatia, will be the first company in the Balkans to manufacture medicinal products such as compressed tablets, serums, and medicinal plant products. The company will cultivate medicinal plants on a large property adjacent to the railway between Karlovatz and Ljubljana (Laibach).—(*U.S. Com. Rep., Apr.* 13, 1921.)

OFFICIAL TRADE INTELLIGENCE.

(*From the Board of Trade Journal for June* 9 *and* 16.)

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1, from firms, agents, or individuals who desire to represent U.K. manufacturers or exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department and quoting the specific reference number.

Locality of firm or agent.	Materials.	Reference number.
Bermuda	China, glassware	716
British West Indies	Soap, perfumery	717
,,	China, glassware	718
South Africa ..	Crockery, glassware	705
,	Crockery, glassware, bottles, sheet glass, plate glass	707
Hungary	Raw materials for medicines, vegetable fibres, cork	729
Italy	Malt..	711
Sweden	Leather belting	733
,, ...	Chemicals for pulp, paper and other industries	734
Morocco	Galvanised sheets, electric light bulbs (120 volts)	713
Argentina ..	Heavy and fine chemicals ..	714

TARIFF. CUSTOMS. EXCISE.

Czechoslovakia.—The "Manipulation" fees on exports affect cardboard, chemicals (except hydrochloric acid), chloroform, cellulose pulp, collodion, cyanide, dyes, faïence, glass, gold, kaolin, artificial leather, matches, mineral wax, paper, photographic goods (except films), polish, platinum, porcelain, rubber goods, silver, tar and derivatives thereof, yeast, etc. Such fees are payable on imported hops leather, photographic films and papers, stoneware, and tannin.

France.—Extracted fats (wool grease, etc.) may now be exported without special authorisation.

The export duties on edible and other oilcakes have been abolished. The export of raw cattle bones is permitted subject to a duty of 3 fr. per 100 kg. The export of natural phosphate of lime is allowed until further notice to all destinations.

Germany.—Albumin may be exported without licence as from May 28.

Germany (*Occupied Territory*).—Import licences are not required for fats, hides, and iron ore, nor export licences for bricks and certain leather goods.

Greece.—A copy of the decree controlling the trade in opium, morphine, cocaine, heroin and preparations thereof may be seen at the Department, 18, Queen Anne's Gate, S.W. 1.

The import of sodium carbonate is again allowed.

Hungary.—For the purpose of the payment of customs surcharge, goods are divided into three classes. Goods in list A include cardboard, newsprint paper, and certain chemicals, and are surcharged 1100 per cent. List B, on which the surcharge is 1900 per cent., includes paper, fine cardboard, rubber, tanned skins, glassware, pottery, firebricks, crucibles, and certain chemicals.' Goods in list C are surcharged 3400 per cent. Full particulars may be obtained on application to the Department.

Italy.—As from April 1 the payment of customs duties on a gold basis has been resumed. Payments may be made by certificates to be obtained from the Banks of issue at a price fixed fortnightly by the Minister of the Treasury.

The import of dyes and intermediates is prohibited, but certain exceptions may be specified from time to time by the Minister of Finance.

Japan.—The new tariff amendments came into force on June 1.

Nigeria.—As from June 1, in order to import morphine, cocaine, ecgonine, diamorphine, and medicinal opium the importer must furnish the Government with a statement in quadruplicate of his requirements and a guarantee that the consignment is required for legitimate scientific and medicinal purposes; the name of the firms supplying the drugs should also be stated.

Nyasaland.—The customs tariff has been revised with effect from April 1. All goods (with some exceptions) pay an import duty of 10 per cent. *ad valorem.* Among the articles that are duty-free are manures, disinfectants, insecticides, and drugs of the British Pharmacopœia.

Export duties are payable on gold and beeswax.

Poland.—The import of vinegar is prohibited. Zinc may be exported without licence as from April 16.

Portugal.—Export licences are required for, *inter alia*, butter, lard, olive oil, and sugar.

Goods on which export surtaxes are payable include lard, butter, matches, scrap iron, rosin, certain hides and skins, wolfram ore, and tin.

Rumania.—The export taxes on certain petroleum products have been modified.

Commission charges are levied on the export of certain seeds, sunflower oil, oilcakes, timber, carbide, carbon bisulphide, bleaching powder, gypsum, soap, salt, bitumen, grease, tar, pitch, petroleum products, lard, cement, tarred paper, old iron, manganese iron, oak bark, and shoemakers's glue.

San Salvador.—The import duty on gasoline has been reduced to 1½ centavos (gold) per kg.

St. Vincent.—A copy of the regulations relating to certificates of origin under the British preferential tariff may be seen at the Department.

Spain.—Modifications of the new provisional customs tariff affect coal-tar colours, aniline oil and hydrochloride, and pulp for paper making.

Surtaxes have been levied on all classes of goods.

Within the 8 months ending February 3, 1922, 25,000 metric tons of sugar may be exported.

Sweden.—Export prohibitions have been withdrawn from vegetable fibres, premier jus, oleomargarine, malt, starch, flax seed, rape seed, liquorice, and sweetened condensed milk.

Increased import duties are payable on hops, liquorice, cumin, certain spices, vanilla, saffron, incandescent mantles, and wares of gold, silver, and platinum.

Switzerland.—Import licences are no longer required for paper, cardboard, bottles, and certain manufactures of iron, copper, and of copper alloys when imported over the Franco-Swiss or Italo-Swiss frontiers.

Tunis.—The prohibition of the import of paper on reels and pulp for newsprint paper has been abolished.

Venezuela.—The regulations affecting the import, manufacture, and sale of foodstuffs may be seen at the Department.

REVIEWS.

Famous Chemists: the Men and their Work. *By* Sir William Tilden. *Pp.* 296. (*London: George Routledge and Sons, Ltd.; New York: E. P. Dutton and Co.* 1921.) *Price* 12*s.* 6*d. net.*

Sir William Tilden has written a book which will be not only a very convenient book of reference for chemists, but will appeal to general readers who desire to learn the main characteristics and achievements of some of the great men—from Boyle to Ramsay—who have built up the science of chemistry.

The question at once arises—who shall be included in such a book? As a guide to selection the author has taken the evolution of the atomic theory, and has chosen the men who, in his judgment, have taken the leading part in establishing, step by step, the idea of the chemical element and the quantitative laws of chemical combination, the men who have isolated new elements and those who have explained the structure of molecules from a study of the properties of atoms. If twenty-one names had to be selected from those whose work appeared indispensable to the progress of the theory, chemists would not differ greatly from the author in their choice. In making an independent selection the writer was surprised to find how many of the same names were included; indeed, in the case of the older chemists, he can congratulate himself in "spotting" eleven out of the first twelve. This concordance no doubt is due to the perspective of time: when details are lost the great realities can be seen.

For all the chemists he has chosen Sir William Tilden has given good reason why he has selected them as "indispensables," and why their fame should be preserved; and if we have a doubt in any particular case and think, for instance, that Proust would hardly have persuaded the world that Berthollet was wrong in questioning the universality of "definite proportions," had it not been for Dalton's atomic theory and the law of multiple proportions which Proust himself failed to see—well, we all admit that Proust did brave work and are glad to have the details of his life. Among modern atomic chemists we welcome the inclusion of Alexander Williamson as one of the great upholders of the theory, the inventor of the water-type and the first chemist to introduce the idea of intermolecular exchange, which lies at the root of the modern doctrine of ionisation.

If, where there is so much to praise, it is the critic's business to seek a point or two to debate, one point shall be on a matter of judgment, the other on a small matter of fact. In Dalton's life no mention is made of his experimental determination of the law that all gases under the same conditions expand alike for equal increments of temperature. Under Gay Lussac we find this reference:—" . . . . like Dalton, he also adopted the erroneous idea that the expansibility of all gases was the same." Now Dalton, working with oxygen, hydrogen, nitric oxide and carbon dioxide, found that the actual expansion became less as the temperature rose, but all the gases behaved alike, and it is the equality of expansion of the different gases which he lays stress upon. Surely this generalisation which all continental writers ascribe to Gay Lussac, and was first enunciated by Dalton, had an important influence on the development of the atomic theory—in spite of the fact that neither experimenter determined the true coefficient of expansion. As to the matter of fact—a small fact admittedly—is Sir Wiliam Tilden (in company with most other chemists) justified in questioning the authenticity of "the pear-shaped vessel commonly called Cavendish's Eudiometer"? The writer has in his possession a glass "pear-shaped vessel" made by Newman; it was given to him 40 years ago by the Rev. T. H. T. Hopkins, Fellow of Magdalen, with this history:—It was made originally by Newman for Cavendish, and was brought back by Newman after Cavendish's death; it was purchased from Newman as Cavendish's instrument by Professor Daubeny, of Oxford, who left it to his friend Hopkins. The "Eudiometer" is a very thick-walled explosion vessel, the platinum firing-wires being fastened by cement in holes bored through the glass-stopper, which is clamped down just as shown in the Cavendish Society's plate.

Every chemist will find some new facts in this book, and will be pleased to see the old facts so skilfully arranged. Sir William Tilden has made excellent use of his materials, and every picture leaves a brilliant impression on the mind: he brings out the environment in which his heroes worked, and the stimulus they gave to their contemporaries. The word "heroes" is used designedly; for the author, if he errs at all, errs by way of admiration, and, only touching lightly on the controversial, rightly sets forth the good that is to be remembered.

Harold B. Dixon.

Les Vernis. *By* Ch. Coffignier. *Preface by* M. Haller. *Encyclopédie de Chimie Industrielle. Pp.* xviii.+640. (*Paris: J. B. Ballière et Fils.* 1921.) *Price* 40 *francs.*

Coffignier's book forms a welcome addition to the literature of the varnish industry. It opens with a very full and valuable account of the various gum resins, giving their origin, properties, chemical composition, and where possible tests for their recognition. The oil-resins, balsams, and also the artificial aldehyde-condensation-products, such as Baekelite, now being introduced as substitutes, are described. Asphalt and colouring matters, such as turmeric, aloes, and coal-tar colours follow. The analysis of gums is then given, including the acid and saponification values, which serve as useful guides. The iodine number, which the author rightly carries out with Hubl's solution, and not by Wijs or Hanus, as the gums are more soluble in alcohol than in acetic acid, proves of great value in determining the class of gum; but scant attention is paid to the action of air on the gum resins, as in the weathering of gums.

In the chapters on oils, linseed oil is first treated fairly well, but too little attention is paid to the constants of different varieties, such as iodine values. The same criticism applies to the other oils, such as tung, lumbang, soya, and some of the lesser known oils which are mentioned. This fault, however, is almost remedied in a later chapter on the analysis of oils. Apropos of the iodine value, the author still gives the view that the iodine is absorbed from the various solutions in the form of hypoiodous acid, which was disproved years ago (*cf.* J., 1902, 587). Little mention is found of the important hexabromide test, whilst the obsolete Livache test, and other more or less unknown methods, occupy too much space. The description of turpentine and its substitutes, their preparation, composition and properties are adequately treated.

The cleansing, garbling, crushing and, later, the running of gums, both at the ordinary pressure and in the autoclave, are ably described, and the boiling of the oil to be subsequently added is given, together with numerous recipes for special varnishes. A discussion of the action of driers on oils follows the latest theories with regard to their action on raw oil, but one is surprised to find reference to zinc salts, as, if pure, they have no drying action. No mention is made of the work of Morrell (*cf.* J., 1915, 108) on the polymerisation of unsaturated oils under the action of heat, or the bearing of this on the character of the film left on drying, nor is there any reference to the greater permanency of a polymerised ("polyolin") film compared with that of an oxidised ("linoxyn") one, and the relation of "super-oxidised" oil to this matter (*cf.* Ingle and Woodmansey, J., 1919, 101).

The volume is very comprehensive, but it leaves an impression that the author has omitted some useful work published in English journals of late years. Nevertheless, the book covers the subject more fully than any English or German work known to the writer, and the only adverse criticism to be made is that the arrangement of the subject matter causes the details to be diffused, instead of being confined under their particular subject titles.

HARRY INGLE.

An Introduction to the Chemistry of Plant Products. Vol. I. On the Nature and Significance of the Commoner Organic Compounds of Plants. *By* Paul Haas *and* T. G. Hill. *Third edition. Pp.* xiii.+414. (*London and New York: Longmans, Green and Co.* 1921.) *Price* 16*s. net.*

In the preface to the first edition of this book the authors explained that it was designed to meet the needs of students of vegetable physiology, whose chemical knowledge is frequently "deficient in just those branches of chemistry which are of particular importance to the botanist, which is no doubt largely due to the fact that those compounds, which are of interest to the botanist, do not necessarily fit into the scheme of instruction of the chemist." Though nearly nine years have elapsed since then, this statement remains true, and the third edition of the book is on much the same lines as the first, with the exception that certain sections have been added to or rewritten, and that it is now issued in two volumes. Volume I is similar in scope to the full work in the two earlier editions; Volume II, which is to be published subsequently, will deal with physiological problems more fully than has been attempted hitherto.

The fact that the book is now in its third edition shows that it is meeting a real need on the part of students. The subject matter is arranged roughly into groups of products, *e.g.*, fats, carbohydrates, glucosides, tannins, pigments, nitrogen bases, etc. Hydrocarbons are omitted in spite of the fact that plant constituents include such an interesting and varied collection of substances of this class as paraffins, terpenes, rubber and gutta-percha. Similarly resins and essential oils are excluded.

The contents of the various sections seem quite adequate and up-to-date, so far as scientific information is concerned. It is doubtful whether it is worth while to include quite so much elementary chemistry as is given in the section on fats, oils and waxes. No one could read this book with profit without a considerable knowledge of chemistry, and for such readers it is surely unnecessary to explain what is meant by a paraffin and to set out in full the constitutional formulæ for ethane and propane (p. 9). Further, to rise from this to the complex Windaus formula for cholesterol (p. 17) in nine pages argues a greater absorptive capacity and more aptitude for the niceties of constitutional formulæ than the average beginner possesses. Much of the analytical detail concerning oils and fats could also be omitted as it is readily available elsewhere. In dealing with tannins no attempt is made to describe the estimation of tannin, and the section gains by the omission.

To readers of this journal there is no need to enlarge on the commercial and industrial importance of plant materials—the existence of such industries as those dependent on rubber, oilseeds, foodstuffs, fibres and cotton is an ever-present reminder of the great interests concerned in them. The authors exhibit a laudable desire to emphasise the economic side of the subject by frequent references to the industrial uses of the products they describe and to the processes employed in their preparation. Some of this information needs more thorough revision than it has received. For instance, though it is admittedly difficult to give a crisp, complete and accurate description of a varnish, one of the things it probably never is, is a "mixture of boiled oil with gum resins and oil of turpentine," if the term "gum resins" is used accurately.

The subsection on the "Industrial Uses of Vegetable Fats and Oils" omits all reference to palm-kernel oil except as a soap material, says nothing about the use of cottonseed oil for edible purposes, and states that palm oil has a faint odour resembling that of violets. In making the latter assertion the authors are in good company, but the statement is usually made with the qualification that the oil has this odour when fresh, and as few Europeans have the chance of smelling it in this condition the assertion in this form is more or less credible, but one would hardly associate violets with ordinary palm oil as it reaches this country.

Most of these remarks, it will be seen, refer to the chapter on oils and fats which, however, it is only fair to say, is the weakest portion of the volume. Taken as a whole the book fulfils the objects the authors had in view in writing it, and is in most respects a useful summary of well-selected information regarding those constituents of plants that are of primary importance to the physiologist and the biochemist.

T. A. HENRY.

PUBLICATIONS RECEIVED.

A Dictionary of Chemical Solubilities. Inorganic. *By* A. M. Comey. *Second edition, revised and enlarged by* A. M. Comey *and* D. A. Hahn. *Pp.* 1141. (*New York: The Macmillan Co.* 1921. *Price* 72*s.*

A Text-book of Inorganic Chemistry. Vol. IX. Part II. Iron and Its Compounds. *By* J. Newton Friend. *Pp.* 265. (*London: Charles Griffin and Co., Ltd.* 1921.) *Price* 18*s.*

A Text-book of Assaying. *By* C. *and* J. J. Beringer. *Revised by* H. R. Beringer. *Fifteenth edition, revised. Pp.* 471. (*London: Charles Griffin and Co., Ltd.* 1921.) *Price* 12*s.* 6*d.*

A Dictionary of Applied Chemistry. Vol. II. Calculi-Explosion. *By* Sir E. Thorpe, *assisted by eminent contributors. Revised and enlarged edition. Pp.* 717. (*London: Longmans, Green and Co.* 1921.) *Price* 60*s.*

Condensed Description of the Manufacture of Beet Sugar. *By* F. Murke. *Pp.* 175. (*New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.* 1921.) *Price* 15*s.*

The Composition and Utilisation of Exhausted Molasses in Mauritius. *By* H. A. Tempany *and* C. D. D'Avione. *Bulletin No.* 21. *General Series. Department of Agriculture, Mauritius. Pp.* 15. (*Port Louis: F. S. Passingham.* 1921.)

Report on Lac and Shellac. *By* H. A. F. Lindsay and C. M. Harlow. *Indian Forest Records. Vol. VIII, Part I. Pp.* 162. (*Allahabad: The Pioneer Press.* 1921.) *Price Rs.* 2-12-0.

FUEL PROBLEMS OF THE FUTURE.*

The most pressing fuel problem of the near future is bound up with the social ideals of the mining class, and the present standard of living of the miner can only be maintained by co-operation between owners and miners, together with consideration of the more efficient use of fuel, which is essential if a higher price is to be paid for coal. The effects of the depreciated quality of the coal raised during and since the war point to the advisability of safeguarding the interests of the consumer by extending the system of charging now being applied to the gas industry; the price of coal should be based upon the potential therms which it contains. As an example of the increased ash content of coal, the experience of the Central Electric Supply Co. is noteworthy; for thirteen weeks the average ash content was 18·4 per cent. and the cost 45s. 2d. per ton, whereas during the winter of 1914-15 the ash was only 13 per cent. and the cost 14s. 6d. per ton. The future of British iron and steel production is closely associated with the future price of coal, and although the opinion has been expressed that the industry might recommence with a reduction in the price of suitable coal to 18s. or 20s. per ton, it is considered doubtful whether it could ultimately hold its own in the world markets unless the price of coal reverted to its pre-war level. With a large capital expenditure a saving of 10 cwt. of coal per ton of finished steel might be effected by a grouping of works such as was suggested by the Coal Conservation Committee (*cf.* J., 1918, 345 R).

The total world output of coal, including brown coal and lignite, during 1920 amounted to 1300 million metric tons, of which the United States produced 45 per cent., the British Empire 22 per cent., Germany 19 per cent., and other countries 14 per cent. The rapid development of the production of brown coal is most significant, and in Germany is based on sound knowledge and experience. During 1920 the world's production amounted to 140 million tons, about 11 per cent. of the total coal. Of this quantity Germany produced 111·6, Czechoslovakia 19·7, Jugoslavia 2·5, Austria 2·4, Italy 1·6, Netherlands 1·4, France 1·0, and Spain 0·5 million tons. The output in Germany in 1919 was only 93·8 million tons. From a European point of view the importance of this brown coal must not be gauged in terms of its moderate percentage of total coal. Germany has solved her own fuel problem, and according to the extent to which her requirements can be met by the development of lignite, peat, and water power the output of her coal mines will be available for export. Although a less concentrated fuel, brown coal can be won at a lower cost than bituminous coal owing to the nature of the deposits. Less labour is required, and the costs of sinking, timbering, pumping, and ventilating deep mines are eliminated. The material contains 40 to 60 per cent. of water, but it can be dried, briquetted and carbonised under favourable conditions, and represents the cheapest source of thermal units.

In Victoria it is estimated that there are deposits amounting to 30,000 million tons in Central Gippsland. The main deposits are admirably suited to open cast working on a large scale, and since the commencement of developments in 1916, 400,000 tons of brown coal has been produced. It is estimated that the cost at the mine can be reduced to 2s. 3d. per ton. In Canada experiments are being made upon the brown coals of Manitoba and Saskatchewan.

The world's output of oil in 1920 was about 97 million tons, of which the United States produced 64·8 per cent., Mexico 23·3 per cent., Russia 3·5 per cent., Dutch East Indies 2·5 per cent.; India 1·2 per cent., Rumania 1·1 per cent., Persia 1·0 per cent., and other countries 2·6 per cent. This quantity represents 7 per cent. of the fuel output of the world if reckoned in tons, or 10 per cent. if reckoned in potential therms. In the United States it is realised that the peak of production of American petroleum must soon be passed, and attention is being directed to foreign sources of supply, to the oil shales of the Western States, and to the possibilities of alcohol.

Experiments carried out during the past year in this country indicate that high yields of alcohol per acre may be obtained by the cultivation of Jerusalem artichokes; further, an examination of the artichoke stems has shown that it may be possible to convert them by simple treatment into paper pulp. In the Empire overseas alcohol may be produced for local use, but it is unlikely that it can be imported into this country until it can be produced from waste materials capable of easy collection and treatment in quantity.

The utilisation of peat can only be of local importance owing to the fundamental difficulties connected with the development of an area sufficiently wide to supply a large central station. The Fuel Research Board is in close touch with investigations in Canada and is making trials with Irish peat (*cf.* J., 1921, 229 R).

Coal is likely to remain the chief source of fuel for the world at large, and our greatest fuel problem is to decide what proportion of our present output of coal it will pay to submit to a preliminary treatment for the sorting out of fuels of higher availability. No opinion can be expressed upon the economic side of low-temperature carbonisation until technical problems have been solved in an industrial plant. If it is proved to be a feasible commercial proposition the most natural result would be a replacement of the 35 million tons of raw coal now used annually for domestic purposes. The treatment of this coal would involve a capital expenditure of 30 to 40 millions sterling, to provide for which a gross profit of 5s. per ton of coal carbonised would be necessary. The possible thermal efficiencies of boiler plants are such that only in special cases where there is a local market for rich gas can the capital expenditure upon plant for the preliminary carbonisation of boiler fuel be justified. The work of Mr. D. Brownlie upon the efficiency of boiler installations shows that there is an enormous scope for economy in the use of coal used for steam-raising.

Fuel problems now have a special interest for the gas industry in view of the wider choice of method of gas manufacture which it possesses. The percentage of the potential thermal units of the coal sold in the form of gas may be increased by the manufacture of water gas in a separate producer or within the gas retort. At the Fuel Research Station experiments have been conducted with the special object of determining the effect of admitting steam to vertical retorts, during the carbonisation of coal, upon the yields of tar and ammonia. Working at a temperature of 1260° C., and using 21 per cent. of steam, it was found that the potential heat of the coal obtained in the form of gas was increased from 23 to 33 per cent.; with an extra fuel expenditure amounting to 10 therms the increases obtained were 22 therms in the form of gas, 34 lb. of tar, and 6 lb. of ammonium sulphate per ton of coal.

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* Abstract of the "James Forrest" lecture delivered by Sir George Beilby before the Institution of Civil Engineers, on June 28, 1921.

* The action of the British Government in connexion with power alcohol was fully reviewed (*cf.* J., 1919, 250R, and 1920, 277R.)

SULPHURIC ACID DURING THE WAR.[*]

H. J. BAILEY.

Sulphuric acid may be said to be the life-blood of an industrial nation in times of peace and in times of war the first essential for the manufacture of explosives. During the late Great War the manufacture of sulphuric acid in sufficient quantities and of suitable strength occupied the serious attention of every belligerent country. In the present paper an endeavour has been made to show how the problem was dealt with in this country, with the resultant effects on dependent industries; the figures given are published with the consent of the Ministry of Munitions, in whose service they were mostly compiled. In regard to many of the pre-war figures and of those of 1914 and 1915, it has only been possible to compile an estimate on the best information obtainable; these figures are given in brackets, and should be taken as approximate estimates only. The general position of the sulphuric acid and fertiliser trades has already been dealt with in the Report of the Departmental Committee published by the Board of Trade in February, 1919 (*cf.* J., 1919, 90 R).

During the winter of 1915–16 the following main lines of policy were adopted:—(1) That, wherever possible, the use of sulphuric acid should be partially or wholly replaced by suitable substitutes, such as nitre cake. (2) That sulphate of ammonia, which was being used for the manufacture of ammonium nitrate, should be replaced as far as possible by concentrated ammonia-liquor, thus reducing the amount of sulphate of ammonia manufactured and liberating a corresponding amount of sulphuric acid. (3) That recovery of waste sulphuric acid at explosives works should be insisted upon, and that as far as possible the recovered acid should be again used in the manufacture of further quantities of explosives.

(1) The substitution of nitre cake for sulphuric acid was, in itself, almost a romance of the Department, and is specially dealt with in a paper published in the Society's *Journal* (Dec. 15, 1920, 407 R). (2) There was very little plant in the country for producing a quality of concentrated ammonia-liquor of about 25% strength which was reasonably free from sulphides and carbonates, and which was suitable for use in the ammonia-soda process for the production of ammonium nitrate. Therefore new plant had to be erected for the production of such liquor at various coke ovens, gas works and chemical works. At a later date, when the Swindon factory came into operation, the crystallisation process adopted there necessitated the use of ammonium sulphate as such, and consequently the supply of concentrated ammonia-liquor which was foreshadowed in 1916 had to be curtailed and replaced by ammonium sulphate, with the result that the full saving of sulphuric acid contemplated was not attained. (3) Steps were taken to have the necessary recovery-plant erected at all explosives manufacturers' works, and during the whole of 1916 such construction was being carried out, with the result that the over-all requirements of sulphuric acid for the manufacture of explosives, including that used for the nitric acid required, were eventually reduced per lb. of explosive manufactured to less than one-half of that used during 1915.

Below is set out in tabular form the over-all figures of sulphuric-acid production, etc. during the years 1915—1918. The production of oleum is given in terms of 100% sulphuric acid produced from the raw materials, namely, pyrites and sulphur, used on the contact plants, and does not include any acid brought in from outside sources for strengthening-up on such plants. Practically the whole of this fuming acid or oleum was used in the manufacture of explosives.

Summary of Production and Utilisation of Sulphuric Acid

(in terms of 100 per cent. H_2SO_4).

Tons.

	(1915).	1916.	1917.	1918.
Production by contact plant—				
Govt. factories ..	(—)	42,177	138,859	112,178
Trade	(33,445)	63,496	82,227	54,465
Total ..	(33,445)	105,673	221,086	166,643
Imports	(31,332)	5,716	1,790	—
Production in chamber-acid plant ..	(1,050,000)	1,208,275	1,160,789	964,158
Total available ..	(1,114,777)	1,319,664	1,383,665	1,130,801
Quantity of chamber acid used to manufacture concentrated acid (10% loss allowed in process) ..	(123,500)	371,710	375,517	204,814
Concentrated-acid production (from chamber-acid plant)	(111,150)	334,540	337,965	184,333
[*]Used as follows:				
For explosives ..	(36,150)	258,540	274,689	130,114
For trade ..	(75,000)	76,000	63,276	54,219

[*] A sharp division between explosives and trade is extremely difficult to make, but the figures given are substantially correct.

In the summer of 1917, the continued submarine menace made it imperative to take a careful survey of the raw materials required for the manufacture of sulphuric acid, and from that time forward the supplies of pyrites and spent oxide were brought directly under Government control. Sulphur supplies from abroad were under direct control by the Government throughout the war.

Sulphur Pyrites.

Tons.

	1914.	1915.	1916.	1917.	1918.
Shipments to United Kingdom ..	781,000	1,008,000	969,000	925,000	809,000
Home-mined, including coal brasses.	(6,000)	(6,000)	(6,000)	7,000	21,000
Consumption for acid-manufacture	(800,000)	(800,000)	(922,000)	(871,000)	744,000
Stock in United Kingdom, Dec. 31 (in acid-works and stores)	(150,000)	(250,000)	(200,000)	333,000	436,000

Pyrites, the main raw material for the manufacture of sulphuric acid in the United Kingdom, represents about six-sevenths of the sulphur-material required in this industry, and prior to the war was chiefly imported in a form containing 1—3 per cent. of copper. The burnt residues from pyrites, known as "purple ore," were passed on to copper-extraction works where the copper was extracted and the resultant product rendered suitable for use in blast furnaces. This product is commonly known in the trade as "Blue Billy." It was considered necessary to build up a reserve of this essential raw material for possible use by our Allies as well as by this country, and during the years

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[*] From a paper read before the Manchester Section on April 1, 1921.

1915—1916 shipments of pyrites were greatly increased over pre-war figures. In order to obtain these increased supplies, certain stocks of pyrites from which the copper had been extracted, commonly known as "washed pyrites," were brought into this country.

It has been impossible to obtain complete data of the quantity of sulphur pyrites actually imported during the war period for acid-manufacture alone, as considerable shipments had been arranged for on behalf of the copper-smelting industry, and consequently in the above table the shipments to the United Kingdom during the years 1915—1916 include certain quantities of pyrites of which there is no exact record of use.

Pyrites Cinders.—The pyrites, after being burnt in the sulphur-furnaces as a raw material for the manufacture of acid, gives residual pyrites cinders of about 70—72% of the original weight, and it was found that the total capacity of copper-extraction plants in the United Kingdom was sufficient to deal with 550,000 tons of pyrites cinders per annum; of this plant slightly more than one-half was located in acid manufacturers' works and the remainder at plants belonging to owners of pyrites mines. In addition to the copper-extraction works, it was found that there was crushing and briquetting plant at various blast-furnace works in the country capable of dealing with 200,000 tons per annum of pyrites cinders or iron ores, but the high sulphur content of the untreated pyrites cinders made it impossible to utilise the bulk of this plant for their treatment.

Below is briefly set out a statement for the years 1917 and 1918 of the production and use of pyrites cinders in the United Kingdom:—

	Tons.	
	1917.	1918.
Pyrites cinders produced—		
Cupreous	—	386,060
Non-cupreous	609,000	130,000
Total	609,000	516,000
Pyrites cinders delivered for use in blast furnaces—		
From copper-extraction plants—		
Briqnettes	208,000	208,000
" Blue Billy "	272,000	211,000
	480,000	419.000
Non-cupreous pyrites cinders delivered direct to iron works	45,000	66,000
Total to iron works	525,000	485,000
Stocks of pyrites cinders at acid-makers' works on December 31—		
Cupreous	153,000	130,000
Non-cupreous	99,000	104,000
Total	252,000	234,000

The above figures do not include quantities delivered under contract to sintering plants, as these were not in operation.

Spent oxide is the material resulting from the purification of coal gas with hydrated oxide of iron, and after repeated use and aeration a material results containing approximately 50% of free sulphur. The country was divided into various districts and careful stock accounts were kept and particulars obtained of the receipts and use of this material; these particulars are briefly summarised in the following table:—

	Stock.	(January, 1918, to May, 1919.)			Stock.
Area.	Jan. 1, 1918.	Received.	Used.	Delivered.	May 31, 1919.
A.	676	5,328	4,905	—	1,099
B.	2,062	5,018	6,077	—	1,003
C.	5,526	18,747	17,291	397	6,585
D.	7,010	48,550	46,968	—	8,592
E.	2,250	8,383	8,733	—	1,900
F.	1,153	6,099	6,649	—	603
G.	4,711	9,829	12,343	—	2,197
H.	23,453	49,778	42,934	2,183	28,114
England Total	46,841	151,732	154,900	2,580	50,093
Scotland	287	2,372	2,250	—	409
Ireland	737	1,816	2,069	—	484
Grand total	47,865	155,920	150,219	2,580	50,986

The somewhat heavy rise in stocks during 1917 and 1918 was due to the fact that concentrated ammonia-liquor was manufactured at some of the larger gas works which normally consume spent oxide for the production of sulphuric acid required for the manufacture of sulphate of ammonia. The consequent reduction in output of sulphate of ammonia at these works considerably reduced the quantity of sulphuric acid made during these two years, and led to a decreased consumption of spent oxide.

Sulphur.—A certain amount of sulphur is produced in this country from the Chance-Claus recovery-plant, and as this supply was mainly used for industrial purposes other than acid manufacture, it was not seriously interfered with.

The following table shows approximate quantities of sulphur used during the five years, together with the quantities imported by the Department and stocks:—

Imported Sulphur for Acid-Manufacture.

Tons.

	1914.	1915.	1916.	1917.	1918.
Imports (Government)	Nil	5,700	34,200	52,600	67,800
Used for acid-manufacture ..	(3,600)	(4,000)	(6,400)	44,900	34,200
Stocks, Dec. 31, in Government stores and at acid works	(1,000)	6,000	29,000	26,000	51,000

Sulphuric Acid from Chamber-Acid Plant.

The pre-war production of sulphuric acid in chamber-acid plant was approximately 1 million tons per annum (calculated as 100% acid), and during the years 1915 and 1916 it was necessary to work

Spent Oxide.

Tons.

	1914.	1915.	1916.	1917.	1918.	1919 (Jan. to May, 5 months.)
Received at works	105,000	110,000	119,200	145,600	107,900	48,013
Consumption	108,000	111,000	127,000	119,900	106,100	45,292
Stock at works Dec. 31	31,000	30,000	22,200	47,900	49,700	50,986 (May 31)

available plant in order to obtain the maximum output. In addition, further acid-plant was arranged for by private manufacturers, and during 1916 the demands for acid were only just met by the plant then in existence. It is usual each year for acid-manufacturers to repair and renew portions of the acid-plant in the country during the summer months, when the requirements of sulphuric acid for sulphate of ammonia and superphosphate fall to a minimum.

The chamber-acid plant of the country in March, 1917, comprised 169 separate works owned by 130 different firms, and the approximate number of chambers actually in use or under construction or repair was 1081; there were 353 Glover towers and 425 Gay Lussac towers. At that time the chamber-space per lb. of sulphur consumed per 24 hours averaged 16·5 cb. ft. for the whole country. In March, 1917, when the chamber-acid plant of the country reached its highest production the output obtained during that month represented an annual production of 1,307,000 tons. The demand for sulphuric acid for the manufacture of explosives fell most heavily on the private manufacturers during the year 1916, and the chief difficulty encountered was in providing the national factories and other explosives manufacturers with sufficient concentrated acid, pending the completion of the Government and other oleum-plant then in course of erection.

Sulphuric Acid from Chamber-Plant in terms of 100% H_2SO_4.

Summary of Uses.

Tons.

	1916.	1917.	1918.	1919 (5 mths.).
Explosives ..	352,131	337,765	152,193	5,712
Dyes	17,736	9,688	9,143	5,207
Accumulators ..	2,696	3,145	3,075	822
Alum	24,854	24,406	26,184	11,233
Bichromates ..	8,433	5,710	5,316	1,863
Bleaching powder .	70,413	50,302	50,694	10,471
Copper and copper pickling ..	3,360	2,702	1,339	380
Copper sulphate ..	21,705	27,032	30,424	9,540
Drugs and fine chemicals ..	3,098	4,479	4,225	1,308
General chemicals .	9,203	9,217	9,624	3,734
Chemical warfare ..	39	1,122	1,678	93
Hydrochloric acid .	71,872	53,510	52,227	26,105
Iron pickling ..	54,523	28,864	28,840	25,406
Metal trades, other than copper and iron	3,615	3,263	2,396	1,318
Mineral waters ..	2,421	490	391	1,884
Oil-refining ..	23,690	17,022	14,840	7,238
Paints and antimony colours ..	4,081	3,667	3,684	1,346
Sewage	442	307	723	1,613
Soap and glycerin	2,608	4,060	3,560	1,906
Sugar-refining	925	1,051	1,067	517
Sulphate of ammonia	253,340	230,145	231,092	116,144
Sulphates of magnesia and zinc ..	8,347	9,235	8,339	2,783
Sulphites and phosphates	10,717	11,009	12,504	5,015
Sundries	6,639	5,561	6,006	2,677
Superphosphates & compound manures	169,730	212,209	270,597	144,747
Tar	13,704	14,946	13,897	3,683
Textile industries ..	23,211	15,987	13,323	13,484
Totals ..	1,163,533	1,086,894	957,381	406,229

In the above table the quantities of acid used for oleum-feed, nitric acid and synthetic phenol, have been grouped together under the term "explosives" as it was found difficult to discriminate in certain factories between the quantities used for these purposes and those used directly in the manufacture of explosives.

The figures given are for deliveries and have, therefore, been influenced by action in regard to restriction of use and replacement, wherever possible, by nitric cake. The figures given for the first five months of the year 1919 show the transition that is occurring to normal practice.

The plants in use for concentration of chamber acid in the United Kingdom prior to the war were mainly of the Kessler type, with a few exceptions, where silica cascade concentrators or Gaillard towers were used. Owing to the fact that the French Government was also faced with a similar problem, viz., the necessity of producing quickly large quantities of concentrated sulphuric acid, it was found impossible to obtain the volvic stones required for building further Kessler plant in this country. It was, therefore, decided during the winter of 1915—16, and from that time onwards, to erect plant of the cascade type which could be erected in a few months and be put quickly into operation. At a later date, when experience had been gained with brick substitutes for volvic stones, erection of Kessler plant and Gaillard towers was undertaken, but during the most difficult period of 1916 the production of concentrated acid was mainly obtained from cascade concentrators, and reached the substantial figures of 334,000 tons in 1916 and 338,000 tons in 1917.

Provision had been made for further extensions of the explosives' programme and plant was in existence for producing still further quantities of concentrated sulphuric acid. During February, 1917, the output of this acid reached approximately 9,000 tons per week at acid-manufacturers' works, which represents an annual output of 460,000 tons, and had it been necessary at any time further to increase this output, plant erected after that date would probably have been capable of maintaining an annual output of 500,000 tons. In order to arrange for supplies of sulphuric acid to meet the many essential requirements in addition to those for the manufacture of explosives, it was found necessary to ascertain the exact purposes for which all sulphuric acid was used, and in the following table is set out, in a summarised form, the chief industries in which sulphuric acid was consumed during the years 1916—1918, and also during the first five months of 1919. Owing to the fact that the control of fertiliser-production did not cease until May 31, 1919, it was found essential to continue the control of sulphuric-acid manufacture and use until that date.

Fuming Acid or Oleum.

Particulars of the production and main uses are set out below, the figures given for consumption by trade being mainly of oleum used in the production of dyes, fine chemicals and in oil-refining.

Oleum (20% free SO_3).

Tons.

	1916.	1917.	1918.	1919 (Jan. to May incl.).
Production ..	183,000	367,000	288,000	7,500
Imports	5,500	1,500	—	—
Total ..	188,500	368,500	288,000	7,500
Consumption—				
For explosives ..	179,000	352,000	276,500	—
,, trade ..	6,500	11,000	18,000	12,000*
,, export ..	—	—	1,000	—
Total ..	188,500	363,000	295,500	12,000
Stocks on Dec. 31 ..	11,000	16,500	9,000	4,500 (May 31)

* No separate data available.

It should be noted that in the above table the quantities given are inclusive of feed-acid used, and therefore do not represent the acid made on contact-plant from raw materials only.

The number of contact-acid plants in the country capable of producing oleum prior to the war was extremely limited, but many plants were erected at private manufacturers' works during the war period, and, in addition, the sulphuric-acid plant erected by Government was entirely of this type. Before the war, it is estimated that the plant capacity existing in the United Kingdom for oleum containing 20% free SO_3 was about 25,000—30,000 tons per annum, whereas on December 31, 1918, it is estimated that the output capacity was 450,000 tons per annum, of which approximately 300,000 tons was represented by Government plant. Throughout the war it was found necessary to increase largely the output of this fuming acid by feeding the plant with concentrated acid made at chamber-acid works, so that the total production of this class of acid includes a certain quantity produced in the ordinary chamber-plant and concentrated for feed purposes.

Consumption of Sulphuric Acid for Explosives Manufacture.

During 1915 the demands for explosives compelled the various contractors to increase their output at almost any cost, and consequently throughout that year it was impossible to effect any great economies by recovery of waste sulphuric acid, where plant for this purpose was not already in existence. There were no exact data of the consumption of sulphuric acid for the manufacture of high explosives during 1915, but it has been estimated from such data as are available that it could not have been less than from 5—6 lb. of 100% acid per lb. of high explosive produced.

The figures given below represent the average consumption of sulphuric acid at all explosives manufacturers' works, including Government factories, during the various periods, and although it was impossible to obtain accurate data from the different contractors' works of the stocks of acid in cycle of operation, yet over the periods given, which represent practically three-monthly periods, these fluctuations in stock acids for the whole country do not appreciably affect the results. It will be seen that there was a general progress towards increased efficiency. This increased efficiency was assisted by improvements in working nitric-acid plant, as the consumption of sulphuric acid for the manufacture of the necessary nitric acid is included in the figures given in the following table, where such nitric acid is necessary in the manufacture of the particular explosive. There is no doubt that the national factories assisted greatly in effecting the economies here represented, as they were conducted from the start on the basis of full recovery of waste acid, and valuable assistance was given to the various contractors in the form of technical data which were made available for the use of the various private manufacturers.

Nitric Acid.—During the war the quantity of nitric acid used for general trade—other than for the manufacture of explosives—did not change materially, and during 1917 and 1918 the requirements for this purpose remained steady at about 1000 tons per month, of which rather more than one-half was used in the manufacture of dyestuffs.

During 1917 efforts were made to increase efficiency in the use of nitrate of soda and nitric acid in the manufacture of sulphuric acid. It was found during 1918, for which year alone complete data are available, that 15,800 tons of nitrate of soda and nitric acid expressed in terms of 95% nitrate of soda was used in the production of 964,000 tons of 100% sulphuric acid, or approximately 36·7 lb. of nitrate per ton of 100% acid made.

100% *Sulphuric Acid Consumption per lb. of Explosives made* 1916, 1917, 1918.

	1916.			1917.				1918.		
All acid expressed as 100% H_2SO_4.	March to June.	July to Sept.	Oct. to Dec.	Jan. to March.	April to June.	July to Sept.	Oct. to Dec.	Jan. to March.	April to June.	July to Nov.
TNT— Sulphuric acid, including oleum and that used for nitric acid expressed as 100% H_2SO_4, deducting acid re-concentrated	4·36	3·13	3·04	2·75	2·23	2·24	2·08	2·26	1·96	1·78
Picric acid from phenol— Sulphuric acid for sulphonation, deducting acid re-concentrated	1·93	1·81	1·79	1·50	1·46	1·34	1·26	0·78	0·58	0·57
Sulphuric acid, including that for sulphonation and nitric acid, and deducting quantity re-concentrated	4·75	4·44	4·39	4·18	4·01	3·86	3·66	3·10	2·64	2·66
Picric acid from DNP— Sulphuric acid, including that for nitration and nitric acid and deducting acid re-concentrated	2·90	2·40	2·67	2·58	2·00	2·14	1·96	2·44	1·85	—
Synthetic phenol— Sulphuric acid consumption, including oleum	4·55	3·99	3·49	3·35	3·21	3·08	3·12	2·86	2·30	2·42
Propellants (nitro-glycerin, gun-cotton, etc.) Sulphuric acid, including oleum and that used for nitric acid, deducting quantity re-concentrated	No data	2·29	2·14	1·94	1·71	1·70	1·64	1·51	1·45	1·55

Nitric Acid (as 100% *HNO_3).*

Tons.

	1914.	1915.	1916.	1917.	1918.	1919 (Jan. to May incl.).
Production	16800	85,000	172,500	237,000	158,000	5,900
Factor $\frac{\text{Sulphuric acid used}}{\text{Nitric acid made}}$	(1·5)	(1·5)	1·50	1·47	1·42	1·40
Factor $\frac{\text{Nitric acid made}}{\text{Nitrate of soda (95\%) used}}$ ..	No data	No data	No data	0·67	0·66	0·64

Nitre Cake.

Tons.

	1914.	1915.	1916.	1917.	1918.	1919 (Jan. to May incl.).
Total production	(32,000)	(16,000)	304,271	431,122	289,668	11,211
Total sold and used	(20,000)	(50,000)	155,369	252,857	239,810	10,599
Percentage of production used	(62·2)	(31·3)	51·1	58·7	82·8	94·5

Hydrochloric Acid.

Tons.

	1916.	1917.	1918.
Production 30% HCl ..	272,633	288,991	263,580
Nitre cake used ..	48,085	55,031	47,460
H_2SO_4 consumed (100%)	111,120	107,431	101,707

Consumption of Hydrochloric Acid (30%).

Tons.

	1917.	1918.
Ammonium chloride	7,421	9,572
Aniline	814	1,083
Barium salts	2,446	2,444
Bleaching liquor, powder and chlorine	134,453	125,139
Carbonising	2,526	3,071
Drugs and fine chemicals	3,574	3,950
Dyeing and bleaching	18,148	14,577
Dyes	10,380	14,080
Extraction of metals such as gold, platinum, etc.	3,662	5,285
Foodstuffs and preservatives	1,854	1,743
General chemicals	2,598	1,867
Glue, size and gelatin	4,201	3,295
Leather	1,069	982
Metal-pickling	58,638	53,314
Paint, varnishes, colours, ink, etc. ..	3,279	2,135
Soap and glycerin	9,973	8,128
Metallic chlorides	20,103	12,145
Chemical warfare and explosives ..	459	1,836
Sundry purposes	3,257	2,063
Totals	288,915	266,709

Superphosphates and Compound Manures.—Prior to the war there was a considerable export in superphosphates and compound manures, and although the "Fertilisers and Feeding Stuffs Act" provided for a proper analysis of manures to be available for the farmers' information, it was decided that in fixing prices for fertilisers under the Ministry Orders regard should only be given to those contents which were considered, in the view of the Board of Agriculture, to be of definite manurial value. In consequence of this the Superphosphate Order of August 20, 1917, the Compound Fertilisers Order of October 13, 1917, and subsequent Orders were issued, under which the prices to be charged for superphosphates or compound manures were fixed on the basis of the contents of nitrogen, potash and phosphoric acid, and exports under licence were allowed to a very limited extent. From the tabular statement set out below, it will be seen that the phosphatic manures (made from phosphate rock) available in the United Kingdom during 1916 had reached the very low figure of 460,000 tons in terms of superphosphate, and as the supplies of potash from the Continent were practically cut off and as the use of sulphate of ammonia for agriculture had not greatly increased, there was, therefore, a serious dearth of fertilisers. This state of affairs presented a very serious problem, in view of the necessity of increasing the production of home-grown foodstuffs.

The manufacture of compound manures is carried out by a variety of processes, as the term "compound manures" covers numerous fertilisers which are mixed at manufacturers' works for use for special purposes. In some cases compound manures are manufactured by mixing the ingredients in the usual superphosphate "den," and in other cases by mixing superphosphate already manufactured with various other nitrogenous materials. The position, therefore, in regard to information as to available supplies and requirements was difficult in the first instance, and the fact that many works were engaged in manufacturing on a small scale to meet local requirements also added to the difficulty of obtaining exact data.

The table at the base of the page shows the position in the years 1913—1918 inclusive, from which it will be seen that during the calendar year 1918 the available supplies of fertilisers made from phosphate rock reverted to those of 1913.

For ordinary trade purposes the fertiliser year is taken as from June 1 to May 31, and the figures set out below give a comparative summary of the results obtained during the two years in which the explosives department had to deal with the output of fertilisers.

During the year 1918 labour problems became more acute, and had it not been for the fact that many of the manufacturers were able to utilise female labour in their works it would have been impossible to attain the results set out.

One of the chief difficulties encountered in endeavouring to increase the production of superphosphate and compound manures was that the consumption of these materials is confined to a comparatively short period of the year, and the storage capacity of the manufacturing works is soon filled during those months when consumers are not in a

Superphosphates and Compound Manures.

Tons.

	1913.	1914.	1915.	1916.	1917.	1918.
Imports of phosphate rock, less re-exports	471,000	450,000	374,000	323,000	262,000	464,000
Phosphate rock used in manufacture of fertilisers (1)	450,000	425,000	350,000	280,000	310,000	415,000
Superphosphate (as such) manufactured .. (2)	No data	No data	No data	No data	440,000	584,000
Imported (3)	50,000	50,000	1,000	8,000	15,000	—
Phosphate rock used in manufacture of compound manures in terms of superphosphate (4)	No data	No data	No data	No data	118,000	156,000
Acid (70%) used in manufacture of fertilisers ..	420,000	400,000	330,000	242,470	303,160	386,570
Total superphosphate equivalent of phosphate rock used for fertilisers (taken from 1, 2, 3 and 4) ..	860,000	815,000	631,000	500,000	573,000	740,000
Superphosphate exported (*a*)	64,000	66,000	69,000	14,000	3,000	—
Compound manures exported (*b*)	152,000	127,000	61,000	51,000	27,000	—
Approximate total quantity of superphosphate exported in (*a*) and (*b*)	140,000	130,000	100,000	40,000	17,000	—
Superphosphate equivalent available for consumption in U.K.	720,000	685,000	531,000	460,000	556,000	740,000

Superphosphate and Compound Manures.
Fertiliser years June 1 to May 31, inclusive.

	Tons.	
	1917-18.	1918-19.
Phosphate rock—		
Stocks at works on June 1	70,000	90,000
Imports of rock during year ..	447,000	438,000
Home-mined production	—	3,000
Total available	517,000	531,000
Phosphate rock used for fertilisers..	400,000	430,000
Issued for trench warfare and trade purposes	27,000	13,000
Stock of rock on May 31	90,000	88,000
Total	517,000	531,000
Superphosphate equivalent value of phosphate rock used for fertilisers	710,000	760,000
Superphosphate—		
Production of straight superphosphate	560,000	602,000
Of which was used in the manufacture of compound manures ..	180,000	193,000
And sold direct to consumers ..	380,000	409,000
Compound manures—		
Production of compound manures..	472,000	495,000
In the production of the above compound manures the following materials were used:—		
Superphosphates	180,000	193,000
Phosphate rock dissolved in compounds or used in mixing ..	80,000	87,000
Ground basic slag	4,000	—
Sulphate of ammonia	58,000	67,000
Nitrate of soda	3,000	1,000
Other nitrogenous materials ..	33,000	41,000
Bones and bone-meal	32,000	13,000
Potash materials	6,000	5,000
Total	396,000	407,000
Balance including acid and filling materials such as lime, gypsum, etc.	76,000	88,000
Sulphuric acid used for fertiliser-manufacture in terms of 70% or chamber acid	360,000	374,000

position to accept delivery and utilise the material. During the season 1918—19 it is interesting to notice that the production and deliveries of these fertilisers were mainly confined to the months December to May, in spite of the fact that under the Ministry Orders attempts had been made by the adjustment of prices to induce consumers to buy during the summer months. Of deliveries of superphosphate to consumers, three-quarters of the annual total was delivered during these months, and of compound manures practically four-fifths. It will be seen, therefore, that in order to increase considerably the production of these fertilisers, it is necessary to have works' capacity largely in excess of the annual requirements, as otherwise during the busy months of the season it is impossible to complete the orders. During the two years of control the works' capacity of the country was increased by erecting new plant and effecting repairs and improvements in existing plant in order to deal with a further 100,000 tons of phosphate rock per annum (if the works could be kept going during the twelve months of the year on full output), and of this quantity about one-half was provided by new construction; in actual practice this meant only an approximate annual increase of dissolving capacity for 50,000—60,000 tons of phosphate rock. In the production of some 355,000 tons of compound manures, it was found that about 33,000 tons of nitrogenous materials was used (other than sulphate of ammonia and nitrate of soda) and that this quantity was made up as follows:—

Nitrogenous materials used.	Tons.
Fish waste, meal and guano..	6,000
Leather wastes	700
Dried blood	1,000
Meat and meat meal	1,200
Horns and hoofs	200
Oil-seed, cake and meal	1,400
Slaughterhouse refuse	2,100
Wool waste and shoddy	2,800
Sugar scum	300
Sud cake	6,700
Dried sewage sludge, etc.	2,000
Other nitrogenous materials..	8,600
Total	33,000

In the production of this quantity of compound manures, about 20,000 tons of filling materials was used, composed of gypsum, lime, etc.

Basic Slag.—Before the war considerable quantities of basic slag were exported from the United Kingdom and also imported from the Continent, and from the information obtained from the Board of Trade and the various manufacturers grinding basic slag, the following table has been drawn up to show approximately the quantities of basic slag which were available for consumption in the United Kingdom.

In the spring of 1917 arrangements were made for increasing outputs from the existing grinding plant in the country and also for installing further grinding plant, with the result that during the two fertiliser years (June 1 to May 31) the following results were obtained:—

	Tons.	
	1917-18.	1918-19.
Production of ground basic slag—		
High grade (over 10% P_2O_5) ..	357,000	402,000
Low grade (under 10% P_2O_5) ..	139,000	162,000
Total	496,000	564,000

From the above it will be seen that the amount of phosphatic fertilisers available was considerably increased during the two years of control. The total quantities of phosphatic fertilisers available were as follows:—

Summary of Phosphatic Fertilisers Available.

	Tons.	
	1917-18.	1918-19.
Superphosphates	380,000	409,000
Compound manures	472,000	495,000
Basic slag	406,000	564,000
Total	1,348,000	1,468,000

Basic Slag.
Tons.

	1913.	1914.	1915.	1916.	1917.	1918.
Production	[47,3000	455,000	439,000	434,000	447,000	545,000*
Net exports (allowance made for imports)	118,000	117,000	117,000	39,000	2,000	—
Available for consumption in U.K.	355,000	338,000	322,000	395,000	445,000	545,000

* Of this figure about 70% was high-grade and about 30% low-grade slag.

Ammonia Production and Uses in the United Kingdom in terms of Sulphate of Ammonia.

Tons.

	1913.	1914.	1915.	1916.	1917.	1918.
*Total production of ammonia compounds	433,000	426,000	426,000	434,000	459,000	432,500
Exports of sulphate of ammonia	323,000	313,000	294,000	259,000	63,000	20,000
Exports of other products	14,000	12,000	14,000	15,000	12,000	8,000
Ammonia products used for munitions purposes (ammonium nitrate)	—	—	8,000	50,000	125,000	120,000
Sulphate of ammonia used for agriculture	(60,000)	(60,000)	(60,000)	(80,000)	230,000	246,000
Balance of ammonia products avalable for use in U.K. for other trade purposes	36,000	41,000	50,000	30,000	29,000	38,500

Figures to nearest thousand.

* Figures taken from the Chief Alkali Inspector's Reports and representing about 24½% ammonia content.

Sulphate of Ammonia and Concentrated Liquor.— The demands for ammonium sulphate for the manufacture of ammonium nitrate began to assume fairly large dimensions in 1915, and when the shortage of sulphuric acid became acute towards the end of that year, it was decided to replace sulphate of ammonia by concentrated liquor in the ammonia-soda process for the manufacture of ammonium nitrate. The maximum output of concentrated liquor was attained in January, 1918, when an output was reached corresponding to 148,000 tons of 25% ammonia-liquor per annum.

The two years 1917 and 1918 also included the period when increasing demands were made for sulphate of ammonia for agricultural purposes in this country, and in the table given below is shown in approximate over-all figures the position with regard to ammonia products for the years 1913 to 1918 inclusive.

The figures given for ammonia products for other trade purposes include ammonia-liquor used in the ammonia-soda process, ammonium chloride and ammonium carbonates, and also certain quantities of ammonia products used for other purposes. From the data available, it appears that the requirements for these trade purposes in the United Kingdom are approximately 30,000—35,000 tons per annum, but these requirements, of course, vary somewhat from year to year.

It is interesting to note the increased use of ammonium sulphate for agricultural purposes:—

	1917-18. June 1 Tons	1918-19. to May 31, Tons
Sulphate of ammonia used for agriture	234,000	270,000
Of which was used in compound manures	58,000	67,000

The quantity of concentrated ammonia-liquor made during these two periods in terms of 25% ammonia was as follows:—

As ammonia liquor—June, 1917, to May, 1918 ..	121,763 tons
June, 1918, to May, 1919 ..	58,970 ,,

Dyestuffs Industry Development Committee.— In accordance with the provisions of the Dyestuffs (Import Regulation) Act, 1920, the President of the Board of Trade has appointed the following to be a committee to advise the Board of Trade with respect to the efficient and economical development of the industry:—

Mr. W. J. U. Woolcock (chairman), Mr. Percy Ashley (Board of Trade), Sir Henry Birchenough, Mr. W. H. Dawson, Mr. George Douglas, Mr. E. V. Evans, Dr. M. O. Forster, Mr. L. B. Holliday, Dr. Herbert Levinstein, Prof. G. T. Morgan, Mr. James Morton, Mr. Max Muspratt, Mr. Thomas Taylor, Mr. Norman Thomas (Admiralty), Mr. G. S Witham (War Office).

Another representative of dye-using interests will be appointed shortly.

MEETINGS OF OTHER SOCIETIES

INSTITUTION OF CIVIL ENGINEERS.

A conference was held at the Institution, Westminster, on June 29, 30, and July 1. The president, Mr. J. A. Brodie, was in the chair, and extended a hearty welcome to the deputation of American engineers which had come over to express appreciation of the work done by British engineers in the war. Dr. I. N. Hollis, of Worcester, U.S.A., presented a message from the engineers of America, and in his address stated that a few years ago the American engineering societies did nothing more than hold educational meetings for the discussion of engineering papers, in fact, American engineers treated themselves as men educated and trained to occupy routine, subordinate positions; but they were now climbing out of the rut; they had their own Federation of American Engineering Societies and a central headquarters, the gift of Andrew Carnegie. After Dr. W. C. Unwin had replied on behalf of British engineers, Mr. Ambrose Swasey, the chairman of the deputation, presented the John Fritz medal of the American Engineering Federation to Sir Robert Hadfield, in recognition of his distinguished services to metallurgical science, and in particular for his invention and perfection of manganese steel.

The conference was divided into seven sections, that on Waterworks, Sewerage, and Gasworks being presided over by Dr. Charles C. Carpenter. In a paper on "The Utilisation of Waste Heat in Gasworks," Mr. E. G. Stewart dealt more especially with heat recovery by means of waste-heat boilers. Utilising the flue gases of the carbonisation process, from 500—900 lb. of steam per ton of coal carbonised is at present being generated by means of such boilers. In the "blue water gas" process an economy of 0·66d. per therm may be effected by such recovery. In America, waste-heat recovery in the "carburetted water gas" process is responsible for the production of 80 lb. of high-pressure steam per 1000 cb. ft. of gas.

Dr. J. S. G. Thomas contributed a paper on "Desiderata in the Qualities of Town's Gas," in which he urged that the constituents of town's gas should be such that their combustion yielded only carbon dioxide and water, and that the minimum needless expenditure of energy should be incurred in the distribution of the gas. Sulphur compounds, naphthalene, and cyanogen should be eliminated as completely as possible. For the present no legal restriction should be placed upon the permissible proportions of inert or combustible constituents that may be present.

Messrs. E. H. Richards and M. G. Weeks read a paper on "Straw Filters for Sewage Purification." Laboratory experiments have shown that about 72 per cent. of the nitrogen content of sewage can be recovered by filtration through wheat straw at the rate of 250 galls. per cb. yd. of straw per day.

The best results were obtained after twenty days when the straw had become activated by bacteria present in the sewage. Operations on a larger scale showed a recovery of 65 per cent. of the nitrogen content of the sewage, the resulting manure being odourless and containing 2·06 per cent. of nitrogen.

"Activated Sludge" was the subject of a communication by Mr. J. Haworth, who has found that by suitably agitating sewage sludge in open tanks, activation of the sludge can be effected as efficiently as by the use of compressed and diffused air; the sludge becomes flocculent and contains organisms capable of rapidly clarifying and oxidising fresh sewage. Mr. J. D. Watson described the process of de-watering sludge as practised at Birmingham. Separate tanks are employed for the septic and sedimentation processes. The sludge is transferred from the sedimentation tanks and mixed in the proportion of 4:1 with riper sludge in the digestion tanks wherein fermentation occurs. The rotted sludge therefrom is pumped to the drying beds, where several months' exposure is generally necessary.

A paper on "The Relative Values of Protective Metallic Coatings for Iron and Steel" was read by Mr. S. O. Cowper-Coles. Electro-positive coatings alone were discussed, reference being made to four methods of producing zinc coatings:—The dipping process, sherardising, electro-zincing, and spraying, the advantages and disadvantages of each of which were detailed.

In a paper on "The François Cementation Process," Mr. H. S. Ball described how the efficiency of the cementation process for the prevention of leakage of water into pit shafts, borings, etc., may be increased, more especially when the strata consist of sandstone, by a preliminary treatment of the strata with injections of aluminium sulphate and sodium silicate. Pits treated by the cementation process are practically immune from risks of flooding.

Dr. J. W. Evans reviewed briefly the world's resources of water power in a paper entitled "The Employment of Water Power in the Development of the Mineral Industry." The necessary output of aluminium in this country can only be secured by a considerable development in the utilisation of water power, a project which is hampered by objections raised against interference with the scenic beauty of the areas concerned.

"Recent Developments in Coal-Cleaning Processes" were briefly described by Mr. R. Nelson. The ash content of coal supplies during recent years has, on the average, increased by about 63 per cent. of its previous value. A flotation process employing water mixed with about 1 lb. of oil per ton of coal has been successfully operated in the cleaning of fines, and the Rheolaveur washing process for cleaning nut coal is being introduced into this country.

The James Forrest Lecture, delivered by Sir George Beilby, is noticed elsewhere in this issue.

INSTITUTION OF MECHANICAL ENGINEERS.

An informal conference upon "Means of Improving the Thermal Efficiency of Heat Power Plants" was held on June 30 and July 1 under the presidency of Capt. H. Riall Sankey. The various sectional discussions were opened by the reading of short papers. Mr. E. V. Evans gave an outline of the Chemistry of Combustion, dealing with the mode of combustion of carbon, with particular reference to the producer-gas reactions, and with the combustion of hydrocarbons. It was shown that when raw coal is burnt, not only are valuable raw materials of the chemical industry destroyed, but the reactions involved in the decomposition, distillation and combustion of the hydrocarbons are necessarily of such a complex nature that it becomes difficult to secure efficient thermal control. The various factors affecting the formation and combustion of smoke were indicated.

Mr. D. Wilson, in a paper upon General Causes of Boiler Inefficiency, dealt with the question of supervision, and urged the desirability of raising the status of boiler-house staff. Reference was made to the work of the Federation of British Industries, and it was suggested that legislation enforcing fuel economy might ultimately be necessary.

Messrs. A. Hutchinson and F. Bainbridge presented a paper upon Blast-Furnace Gases. The part played by furnace gases in the economic history of the metal industry was indicated. Questions of gas-engine design were discussed, and the possibility of saving coal by the use of mixtures of blast-furnace and coke-oven gases was indicated.

Prof. W. A. Bone sent in a paper upon the Low-Temperature Carbonisation of Coal, which showed the importance of the subject in relation to the abatement of smoke produced in domestic fireplaces and to the supply of oil-fuel. The semi-coke from low-temperature carbonisation was demonstrated to be a cheap fuel for heating rooms, because of its high radiant efficiency compared with coal and of its low prime cost per therm compared with gas. Further research was considered necessary upon the "hydro-benzinoid" oils produced in the process. At a temperature of 1000°—1100° F. British bituminous coals yield, per ton, 10 to 15 per cent. of motor spirit and 3000 to 4000 cb. ft. of rich gas.

In connexion with Waste-Heat Utilisation, Mr. R. Nelson urged that wherever possible there should be such re-organisation of processes and co-operation among different undertakings that surplus heat could be utilised on the spot.

Sir Henry Fowler, in a paper on Superheating, said that there were few simpler methods of increasing the efficiency of steam-plants than by the use of superheated steam, which prevented condensation and increased the fluidity and volume. Its adoption had been delayed owing to difficulties of lubrication, but these had now been overcome. The construction of the apparatus employed was simple and the saving in coal-consumption considerable.

Dr. W. R. Ormandy opened a discussion upon Liquid, Powdered and Colloidal Fuels. The advantages and limitations of oil-fuels compared with coal were reviewed, and reference was made to the use of lignite and peat as powdered fuels. Having regard to the efficiency of mechanical stokers, the drying and grinding of coal for injection as a dust was not considered advantageous except in special cases. The preparation and handling of mechanical mixtures of liquid and solid fuels were described and the advantages of their employment discussed.

Mr. H. Moore read a paper upon Liquid Fuel for Internal-Combustion Engines showing the need for improved engine-design so as to make use of heavier oils, particularly in view of the fact that the newer oil-wells are yielding asphaltic crude oils, the residues of which are not suited for present-day heavy-oil engines. The advantage of working engines at a lower speed and with a higher compression was discussed.

Other papers presented to the conference included:—Engine-House Management, by Mr. H. Dunell; Super-Compression and Other Means for Improving the Economy of Internal-Combustion Engines, by Mr. A. E. Chorlton; Automatic Stokers, by Mr. A. W. Bennis; Air-Heaters, by Mr. W. H. Patchell; Feed-Heating and Economisers, by Mr. C. E. Stromeyer; and The Indicator as an Aid to Economy, by Prof. W. E. Dalby.

NEWS AND NOTES.

CANADA.

Lignite Utilisation Board.—Briquettes will soon be available from the new Government plant at Bienfait, Saskatchewan, where an experimental plant for carbonising and briquetting is being erected. The raw lignite is crushed to one-eighth in. mesh, and is then dried and passed to carbonisers, where the volatile matter is reduced to 8 per cent. Coal-tar pitch is added as a binder, and after agitation the product is run through briquetting machines and along a cooling-belt to storage bins.—(*Can. Chem. and Met., June*, 1921.)

BRITISH INDIA.

Camphor and Camphor Oil.—The Board of Scientific Advice, in its annual report for 1919–20, states that for some years past the leaves from coppiced trees of *Cinnamomum camphora* grown at the experimental garden at Kaunli have been distilled at Dehra Dun. The results indicate that the leaves yield approximately 4 per cent. of camphor and camphor oil (about 3 per cent. of camphor and 3·7 per cent. of oil). As the oil contains over 30 per cent. of camphor in solution, it seems possible that the cultivation of coppiced camphor trees for the extraction of camphor might be of industrial importance. The oil after the removal of the camphor will probably prove to be of little value, since, unlike camphor wood oil, it does not contain safrol.

AUSTRALIA.

Papua.—The report on the administration of this territory states that the year 1919–20 was a most successful one, the increases in imports, exports and revenue being large and the returns generally satisfactory. Revenue increased from £61,000 to nearly £80,000, imports from £258,112 to £422,741, and exports from £176,247 to £220,480. During the year there was a considerable increase in the copra exported (4080 t. as compared with 2598 t. for 1918–19), and smaller increases in rubber (242 t. against 207 t.) and hemp (336 t. as compared with 287 t.). Timber also showed an increase, and there is ground for hoping that there will be a further increase in the coming year. Pearls showed a decrease in quantity but an increase in value—17,686 carats, worth £25,577 (28,367 carats, and £21,550). Osmiridium, which has been found in Papua in small quantities for many years, was exported during the year to the amount of 88·5 oz., valued at £2930. The Government Geologist, in pointing out that the demand for the metal is increasing tremendously and the supplies in some parts are growing less, states that there are great possibilities in Papua, the rock in which the metal occurs being almost identical with, and having the same origin as, that in which it is found in other localities. The output of gold increased from 9988 oz. to 11,750 oz. There was no export of copper.

Minerals and Metals in Tasmania in 1920.—The production of minerals and metals in Tasmania in 1920, valued at £1,427,073, is set out below:—

		Tons.	£
Lead		3,855	142,268
Copper		4,791	528,237
Tin		1,310	369,362
Coal		75,429	64,005
Wolfram		71	13,626
Scheelite		105	17,905
Bismuth		0·1	9
Shale		140	172
Iron pyrites		4,440	7,346
Barytes		1,048	4,136
Gold	(oz.)	6,426	29,796
Silver	(oz.)	623,359	166,707
Osmiridium	(oz.)	2,009	77,114

—(*Min. Mag., May*, 1921.)

JAPAN.

Exports of Sulphur.—In pre-war years Japan exported 24,000—27,000 t. of sulphur yearly, mainly to the United States, Straits Settlements, and Australia. With the outbreak of war and the cessation of supplies from Italy exports rose considerably, and aided by large orders from Russia attained nearly double previous figures. After the armistice a decline set in and exports fell below the pre-war level, as may be seen from the following statistics for 1914–19:—

	Quantity. Long Tons	Value
1914	29,008	£184.500
1915	42,118	£248,700
1916	46,513	£621,500
1917	48,062	—
1918	30,431	£356,900
1919	16,126	£203,500

The decline continued in 1920, falling during the period January to September to 10,104 t., valued at £156,148 (*cf.*, J., 1919, 329 R) (kin=1·326 lb., yen=2s.).—(*Chem. Ind., May* 23, 1921.)

SOUTH AFRICA.

The "Oil-Shales" of Impendhle County, Natal.—These shales have been known for some years, but owing to their inaccessibility have received but little attention until recently. In view of the limited amount of development work which has been done, it is not possible to estimate the amount of oil-shale in sight or the probable reserves, but prospects seem quite encouraging. At present the only areas where the seam has proved to be worth developing are at Duart Castle, in the Hlatimbe Valley, and at the Waterfall, in the Umkomaas Valley. At Duart Castle there is a total thickness of 4ft. 5in. of "oil-shale," which really consists of a variety of coal, resembling cannel in some respects, but black, glossy and somewhat laminated; on distillation it is said to yield from 20—40 galls. of oil per ton, low-grade material yielding about 15 galls. per ton. The thickness of the deposit on the south side of The Waterfall is 3ft. 6in., and a small sample taken at random contained moisture 0·7%, volatile matter 34·2%, fixed carbon 39·75%, and ash 25·35%. It is concluded that if further development work be successful, and if the reported yield of oil be maintained, there seems to be no reason why a shale-oil industry should not be built up in the near future in this part of Natal. The chief difficulty will be that of transport.—(*S. Afr. J. Ind., May*, 1921.)

UNITED STATES.

Asbestos in 1919.—The asbestos-mining industry in the United States showed a good recovery in 1919, when production amounted to 1361 short tons ($251,265), or 36 per cent. more than in the previous year (*cf.* J., 1920, 338 R). Asbestos was mined in Arizona, California, Georgia, Maryland, N. Carolina, Washington, and Wyoming by twelve producers. The home production, however, is small compared with the imports of crude asbestos, over 99 per cent. of which comes from Canada, South Africa and France supplying the bulk of the remainder. Imports of unmanufactured asbestos amounted to 135,270 short tons, worth $7,369,685, and imports of manufactured asbestos were valued at $257,381 ($27,476 in 1918), of which the United Kingdom supplied 84 per cent. (54 per cent.). It is stated that although the annual production in Canada is increasing, the output of crude fibre has recently fallen off, the figures for 1919 being crude 4065 t. and millstock 153,507 t., compared with 4313 and 139,143 t. respectively in 1918. Rapid progress is reported in the production of asbestos in South Africa, and a large deposit of low-grade material has been discovered in China.—(*U.S. Geol. Surv., May* 14, 1921.)

The Artificial Silk Industry.—The Cellulose Silk Co. of America has recently purchased the Patterson Mills,. of Chester, Pennsylvania, and proposes to manufacture artificial silk from waste matter by a copper-ammonia process which is said to be superior to any process hitherto used. The Tubize Artificial Silk Corporation, Hopewell, Pa., a subsidiary of the Belgian company, is shortly to start operations using American cotton linters as initial material and American chemicals only. The company will specialise in the manufacture of high-grade yarns for silk underclothing.—(*Chem. Ind., June* 20, 1921.)

The Glass Industry.—According to a preliminary statement issued by the U.S. Census Bureau, the number of glass factories in the United States in 1919 was 367, with a production valued at $254,709,000, as compared with 348 and $123,085,000 respectively in 1914. The chief centres of production were in Pennsylvania (102 factories), W. Virginia (77), Ohio (43), Indiana (35), New Jersey (21), New York (19), and Oklahoma (16). Building-glass was made by 125 establishments, the production being:—Window glass, 368,912,209 sq. ft.; obscured glass (including cathedral and skylight), 33,822,302 sq. ft.; plate glass, 57,612,491 sq. ft.; wire glass, 15,691,486 sq. ft.; all other building glass, $1,886,000. Pressed and blown glass was made by 130 establishments, and bottles, jars, etc., by 139, with outputs valued at $70,708,000 and $87,762,000, respectively.—(*Chem. and Met. Eng., June* 8, 1921.)

Talc and Soapstone in 1919.—The quantity of talc mined and sold in the United States in 1919 was 168,339 short tons, valued at $1,822,512, a decrease of 13 per cent. both in quantity and value as compared with 1918. There were 33 producers; Vermont had the largest production, but New York the most valuable. About 9 per cent. of the output is sold in the crude form, less than 1 per cent. is cut into pencils and crayons, and over 90 per cent. is ground. Imports of talc amounted to 14,602 short tons ($259,004) (3 per cent. more than in 1918), of which 12,973 t. was ground or manufactured talc; Canada supplied about 91 per cent. of the imports, and the remainder came from Italy and France. Soapstone is now produced only in Virginia, where there are abundant supplies; 16,504 t., worth $530,163, was sold in 1919, the quantity being nearly 8 per cent. greater and the value 8 per cent. less than in the previous year.—(*U.S. Geol. Surv., Apr.* 14, 1921.)

Use of Stenches as a Warning in Mines.—Technical Paper No. 244, 1920, of the Bureau of Mines, describes certain advantages which the placing of stenches in the compressed-air lines of a mine offer over the use of electric bells or other means of warning. Among these advantages are convenience of installation, reliability of action, and positive effect upon the miners, the natural instinct being to flee from the ill-smelling air to pure air. The necessary properties of such stenches are non-toxicity, moderate vapour-pressure, disagreeable odour, and availability. With the aid of a special apparatus or "odormeter" for measuring intensity, it was found in the laboratory that of twenty-four chemicals examined, butyl mercaptan, ethyl mercaptan, amyl acetate, butyric acid, and valeric acid were the more promising. A simple apparatus, or injector, has also been devised for introducing the liquid chemicals into the compressed-air lines of mines.

FRANCE.

Industrial Notes.—*Chemical Industry*—The Commission appointed by the Ministry of Agriculture to fix the price of alcohol has decided to base it upon the price of sugar, a decision which appears reasonable but which will probably lead to frequent variations in price. With sugar at 140 fr. per 100 kg., the price of alcohol at the agricultural distillery will be 147·80 fr., and at the distillery where rectification is carried out 160·58 fr.

The chemical markets have not yet attained stability and there has been a considerable amount of liquidation at prices below cost; oil of turpentine, which was quoted at 380 fr. per 100 kg. a few weeks ago, is now quoted at 230—250 fr.

Metallurgy.—There is no sign of activity in the metallurgical market. Many blast furnaces have been closed down and the demand for steel is very small both on home and foreign account. The rolling mills have work in hand for the next few weeks, but the orders for locomotives will keep the makers busy for at least twelve months.

Coal.—The mines of the Nord and Pas de Calais are still (June 23) exporting coal to England at remunerative prices. Messrs. Lambert Bros., of London, acting for the British Government, have contracted to take several hundred thousand tons of Saar coal, to be shipped *viâ* Ludwigshafen and Rotterdam. The output of coal from the Ruhr and the pits on the left bank of the Rhine amounted to 31,827,688 metric tons during the first four months of 1921, as against 26,473,609 t. and 37,096,423 t. for the corresponding periods of 1920 and 1913 respectively.

General.—The most important recent event was the holding of a congress in Paris to consider the development of external trade, and the fact that the Minister of Commerce presided in person indicated that the object in view was to effect a more intimate collaboration between the State and private enterprise. Among the many subjects discussed were raw materials and imported products, production, economic policy, finance, taxation, commercial organisation, and transport, and the most important conclusion reached was that all such matters should be placed under a new ministry, to be called the Ministry of Public Economy, which should be divided into as many departments as were needed, one of which would take over and replace the present Ministry of Labour and a section of another be entrusted with the compilation of national statistics.

GENERAL.

British Dyes and Dyeing.—Two reports by the Sub-Committee of the Standing Committee on Trusts have recently been issued, of which that on Dyes and Dyestuffs (Cmd. 1370, 4d.) contains a historical survey of dye-manufacture in this country together with the opinions of the Sub-Committee on the extent to which supplies, prices and costs of these materials, and profits thereon, are affected by trade combinations. The conclusions—twenty in number—were agreed to by all members except one, Major H. Barnes, M.P., whose minority report is appended. The general tenor of the report is approval of the measures taken by the Government to promote and stabilise dye-manufacture in this country. The formation and financing of British Dyes, Ltd., and of the British Dyestuffs Corporation, Ltd., were justified, and although the latter might be able to obtain a monopoly, the safeguards in its constitution, etc. should obviate this, and also the charging of unreasonable prices. It is not considered that the Corporation is over-capitalised. The dividends paid by the individual companies prior to amalgamation were not excessive and the large profits made during the war were mainly spent on extensions and in writing off capital expenditure. The prices charged by manufacturers during the war were not justifiable on the basis of current production costs; but in some cases the profits were kept in the business and spent on development. "If the dye-industry is to be regarded henceforth as a part of the military preparations of the various nations, the competition in dye-making will assume a character akin to that of the competition in armaments, the productive capacity of the world in dyes and dyestuffs will increase out of all proportion to the world's requirements, and the dye-industries of the various countries will undoubtedly claim State subsidies."

In a schedule to the report percentage increases in the prices of certain dyes are detailed, from which it appears that the average increase in the price of 79 dyes between July, 1914, and March, 1921, was about 770 per cent., the maximum being 2150 per cent. for Rhodamine B, and the minimum 154 per cent. for Theonol Khaki No. 1.

The report on Dyeing, Finishing, Bleaching and Printing (Cmd. 1371, 1d.) is a very short document as the trades concerned refused to furnish the information required, and the application of the compulsory powers conferred by the Profiteering Acts was held to be both inexpedient and impracticable.

Research in the Brewing Industry.—The Institute of Brewing has published a report on its new research scheme (*cf.* J., 1921, 32 R) covering the period from the inception to May 23 last. Experiments on the breeding of new varieties of the hop have been undertaken with the object of obtaining varieties which will resist disease and contain the highest possible amount of resins and other desirable constituents; over 4000 seedlings are being cultivated and analyses of resin-content are being made. Definite results from the experiments undertaken to ascertain the effects, if any, of nitrogenous, phosphatic and potassic fertilisers on the brewing value of the hop strobiles are not to be expected for some years, as differences in composition will not be ascertainable until after the residual manurial elements in the soil from previous applications have been exhausted. Experiments to ascertain the ideal conditions of drying will be started, probably at the next hop-picking season, as soon as the four experimental kilns have been erected. Comparative brewing trials are being made of hops of the best growths and of known purity in order to test their brewing values. At the College of Technology, Manchester, the soft resins have been extracted from a large quantity of sulphured and unsulphured hops and are being examined with a view to obtaining light upon the preservative or antiseptic properties. At the Imperial College the timber investigations, on the botanical side, have up to now been mainly devoted to the structure of the wood of barrels. The American oak so far examined shows features arousing suspicion of its use for barrels as, *inter alia*, although it was all heartwood, it contained starch, *i.e.*, food material vulnerable to attack by fungi and bacteria. The probable reason why the American red oaks differ from the American white oaks in being unsuitable for use in beer barrels is because their pores are not plugged with microscopical bladders (tyloses) and are consequently too pervious. On the chemical side most attention has been given to the examination of various woods to ascertain what variations exist in the amounts of different extracts; wide differences in the qualities of the extracts have been found with benzene, alcohol, and water. Investigations are now proceeding to determine the rate at which beer extracts materials from wood. A *résumé* of the published literature relating to the evaluation of barley from the nitrogen standpoint is nearing completion. The report is published in the July issue of the *Journal of the Institute of Brewing*.

Experimental Gas-Plant at Leeds University.—A gas-plant, specially designed for experimental work, is being erected as an adjunct to the Department of Coal Gas and Fuel Industries of Leeds University by Mr. H. Woodall as a memorial to the late Sir Corbet Woodall. The installation will include a vertical retort-system for high-temperature work, a horizontal retort, and gas-holders. Mr. A. G. Glasgow has made a donation of five hundred guineas towards the cost of the plant.

The Possible Occurrence of Platinum in Cornwall.—In a paper on ore deposits of igneous origin, read before the Cornish Institute of Engineers in April, Dr. R. H. Rastall referred to the fact that Du Parc and Orueta had definitely proved that the original home of the platinum metals occurring in the Ural Mountains and in Spain was serpentinised ultrabasic rocks, and that the alluvial platinum of Colombia is associated with boulders of serpentine. This suggests that platinum might possibly be found in the large areas of serpentine at the Lizard. No recorded assay shows any platinum content in these rocks, but this is not surprising as the amount present would be so small. He suggests that a systematic search for alluvial deposits that have undergone natural concentration should be made and be followed by extensive panning tests and assays. There are not many streams draining the Lizard serpentines, but it would be worth while to test the bedrock of such as there are.—(*Min. Mag., May*, 1921.)

Coke-Oven Gas.—As the efficient utilisation of coke-oven gas has an important bearing on coal conservation, the Board of Trade has recently collected information concerning the production and disposal of such gas in the United Kingdom. In normal times as much coal is used in the production of blast-furnace coke as is carbonised for the manufacture of town's gas. The gas produced in by-product coke ovens amounts to 10,000 cb. ft. per ton of coal and has a gross calorific value of 420—550 B.Th.U. per cb. ft. A proportion of this, 50 to 60 per cent. in the case of regenerative ovens and 66 to 100 per cent. in the case of waste-heat ovens, is absorbed in heating the ovens themselves. This is possibly the most efficient means of using the gas, although it has been proposed to use blast-furnace gas for the purpose. The gas used by coke-oven proprietors for purposes other than heating the ovens amounts to 37,250 million cb. ft. per annum, and the quantity available for disposal is 7250 million cb. ft., some of which is supplied to gas undertakings, and 805 million cb. ft. of which is run to waste. Districts at present supplied with coke-oven gas for domestic and industrial uses include Birmingham, Leeds, Sheffield, Middlesbrough, Wath, Mexborough, Rotherham, Swinton, and Pontypridd.

It is generally admitted that to burn coke-oven gas under boilers is not the most efficient method of utilising it, and other outlets for the gas so consumed are being sought. The possibility of using the gas, compressed to a pressure of 1000 lb. per sq. in., as a substitute for petrol in motor vehicles is indicated (*cf.* J., 1919, 297 R.)—(*Bd. of Trade J., July* 7, 1921.)

Production of Chemicals in Belgium in 1920.—The following figures of production have been issued by the Ministry of Economic Affairs; they were furnished by the fifteen associations comprising the Fédération des Industries Chimiques de Belgique, but are not quite complete:—

Production.	1913.	1920.
	Metric tons.	
Sodium carbonate	31,234	31,000
Sodium sulphate	25,000	40,000
Soda caustic	3,261	2,418
Potash and derivatives of	47,964	40,229
Chloride of lime	7,444	3,970
Calcium chloride	6,025	2,850
Calcium superphosphate	465.000	220,000
Sulphuric acid	600.000	400,000
Nitric acid	10,000	7,500
Hydrochloric acid	22,500	27,000
Ammonium sulphate	22,696	9,048
Benzol (90%)	5,216	4,194
Coal tar	37,337	25,872
Naphthalene	5,593	4,702
Creosote oil	8,705	5,543
Pitch	47,100	28,304
Light oils	6,277	1,785
Soap	18,400	11,570
Explosives, etc.	3,500	2,200

—(*U.S. Com. Rep., May* 23, 1921.)

The Swiss Carbide Industry.—As the home consumption of calcium carbide is only about 3000—4000 tons yearly, the Swiss carbide industry relies mainly upon its export trade which is now practically non-existent. Added to this is the shortage of electric power, owing to the abnormally low water-level. Ability to compete in the world's markets depends upon the price of coal in Switzerland which has recently shown a tendency to fall. At the present time not one of the large factories is producing and hence the only electrode works in the country, the Elektro-Carbon A.-G. in Niederglatt, near Zürich, has practically suspended operations. Swiss electrodes cost 50 francs per 100 kg., and electrodes imported from Germany 20 fr. per 100 kg.—(*Chem. Ind., May* 23, 1921.)

Zinc and Sulphuric Acid in Upper Silesia.—The value to Germany of the zinc-smelting industry in Upper Silesia may be gauged from the fact that before the war this province produced about 60 per cent. of the Empire's total output of zinc. In 1913 there were 16 smelters, 8492 furnaces, and the production was 169,439 metric tons of crude metal from 517,000 t. of ore. This production represented 17·3 per cent. of the world's output (980,000 t.), to which the United States contributed 32·6 per cent., Germany 27·5 per cent., and Belgium 20·4 per cent. In addition Upper Silesia produced 23 per cent. of the total output of coal in Germany. In 1918 the output of crude zinc in Upper Silesia was 122,961 t., in 1919, 74,000 t., and in the first half of 1920, 42,000 t. The number of workers in the zinc and lead mines of Upper Silesia was 10,150 in 1920, as against 11,198 in 1913, and in the smelting industry 6959, compared with 8492 in 1913. The mines are for the most part situated in a small area which includes the districts and/or towns of Tarnowitz, Gleiwitz, Beuthen, Hindenburg, Kattowitz, Königshütte, Rybnik, and Pless. In 1913 the mines produced 400,387 t. of zinc blende, 52,572 t. of lead ores, and 7658 t. of sulphur pyrites; from these ores were obtained 169,439 t. crude zinc, 7149 t. zinc dust, 1337 t. lead, and 386 t. cadmium. The output of sheet zinc was 49,232 t. and of sheet lead 320 t.

The manufacture of sulphuric acid is intimately bound up with the zinc industry. In 1913 Upper Silesia produced 255,589 t. of acid of 50° B. or 9·7 per cent. of the total German production, and also 3137 t. of anhydrous liquid sulphur dioxide; in the first six months of 1919 and 1920 the outputs were 52,887 t. and 87,960 t., respectively. The 1919 production was extraordinarily small and is difficult to understand, but it is significant that the improvement which took place in the early part of 1920 followed quickly after the issue of new Orders concerning the distribution and use of raw materials for sulphuric-acid manufacture and the abolition of Government control over the acid itself.

Oil Shale in Bulgaria.—The following notes are extracted from an article on oil shale in Bulgaria by Dr. V. Kautcheff in the *Near East* for April 28, 1921:—

The increasing demand for oil has led to the investigation of the Bulgarian oil-shale deposits, which it is claimed are the most important ever discovered. Analyses have shown that Breznik shale yields from 10 to 13 per cent. of crude oil, which compares with a yield of 12 per cent. obtained in Scotland from the best grades. A yield of 22—23 per cent. crude oil has been obtained from Serbinovo shale. In Germany it was found possible during the war to work shale profitably that only yielded 5 per cent. of crude oil, whereas second-grade samples from various localities in Bulgaria yield from 6 to 11 per cent. The most important deposits known at present are situated near Breznik, Radomir, and Kustendil, Popovtzi, Kazanlik, and Serbinovo (Gorna Djoumaya). At Breznik the surface shale alone is estimated at 30 million tons, and this, together with the large amounts beneath the surface, should suffice for exploitation extending over a very long period. Up to the present three industrial concessions have been granted for the production and refining of shale oil in Bulgaria, namely, one to British subjects with reserved regions (the Sofia, Kustendil, and Vratza districts), and two to Bulgarian subjects with reserved regions (Stara Zagora, Phillipopolis, and Gorna Djoumaya). The article concludes with the statement that the shale-oil industry in Bulgaria offers great promise, and deserves close consideration by local and foreign capitalists.—(*U.S. Com. Rep., May* 19, 1921.)

Advance Statistics of Production, Exports, and Imports of Certain Metals, etc., in 1920.—The following advance statistics have been compiled by the Imperial Mineral Resources Bureau supplementary to those already published in this Journal (1921, 175 R):—

Production in 1920.

	Long tons.
U. K.—Arsenic, crude and refined	1,097
Arsenical pyrites	1,178
Iron ore	12,707,475
Canada.—Iron ore	114,130
South Africa.—Iron ore	2,289
Swaziland.—Tin ore (metallic content) for fiscal year ending March 31	314
Hungary.—Iron ore	416,497
Mexico.—Lead (smelter production)	119,482
Bolivia.—Tin ore (metallic content)	17,725
Cuba.—Iron ore	300,000
China.—Silver	fine oz. 40,000
Tin ore (metallic content)	6,500

Exports in 1920.

	Long tons.
Canada.—Iron ore	17,749
Australia.—Lead (contents of concentrates and ore)	4,122
Tin (for fiscal year ending June 30)	3,015
Zinc ore	53,732
Spelter	5,689
India.—Spelter	75
Belgium.—Silver bullion	fine oz. 2,782,644
Silver coin	fine oz. 847,463
France.—Iron ore	4,336,651
Norway.—Iron ore (iron ore, concentrates and briquettes)	222,073
Sweden.—Iron ore	3,676,281
U.S.A.—Iron ore	1,145,037
Spelter	76,695
China.—Iron ore	672,150
Lead ore	2,351

Imports in 1920.

	Long tons.
U.K.—Iron ore	6,420,242
Manganiferous iron ore	80,669
Spelter	109,367
Canada.—Iron ore	1,731,199
South Africa.—Spelter	1,301
India.—Tin	2,507
Spelter	4,404
Belgium.—Iron ore	2,380,134
Silver bullion	fine oz. 529,297
„ coin	fine oz. 974,056
„ in ore	fine oz. 14,293
France.—Iron ore	397,363
U.S.A.—Iron ore	1,268,536

The Sugar Industry in Jamaica.—A committee appointed by the Legislature to inquire into the necessity for aiding the sugar industry has reported that the condition of the industry is perilous, that Government assistance is essential, and that the closing of the estates would throw 35,000 people out of work. The committee therefore recommends the adoption of the Government's proposals to guarantee a loan of £400,000 by the banks to help the planters, the security being a first mortgage on the crops and lands.—(*Times, June* 30, *July* 2, 1921.)

Sugar Production in Paraguay in 1920.—The production of the five chief sugar refineries in Paraguay in 1920 was 3639 metric tons of sugar, 418,917 litres of industrial and rectified alcohol, and 199,101 litres of "caña," which compares with 2490 t. of sugar, 377,316 litres of alcohol, and 46,350 litres of "caña" in 1919. The domestic consumption of sugar in Paraguay is estimated to be approximately 3000 metric tons per annum; in 1920, for the first time, sugar was exported, to the extent of 1411 t., mainly to Uruguay.—(*U.S. Com. Rep.*, *May* 13, 1921.)

A New Ochre Deposit in Guatemala.—A large deposit of ochre has been discovered within 24 miles of Guatemala City and within 15 miles of the railway. At present the cost of transport from the deposit to Puerto Barrios is about $24 per ton, but if a market price could be obtained sufficiently high to cover the heavy cost of transport, mining, etc., there would be a good future for the deposit, which is said to be very extensive. Black, dark red, and yellow ochre are found, and the material could be shipped in bags, barrels, or as briquettes.—(*U.S. Com. Rep.*, *May* 20, 1921.)

Manufacture of Superphosphate in Uruguay.—H.M. *Chargé d'Affaires* at Montevideo reports to the Department of Overseas Trade that by a Bill recently sanctioned by the Chambers, the Institute of Industrial Chemistry is authorised to expend the sum of $60,000 on the construction and equipment of a superphosphate factory and the extension of the existing sulphuric-acid plant. A yearly expenditure of $1000 for a period of three years is also authorised for purposes of propaganda and experiments with superphosphates as fertilisers. On the promulgation of the law in question the exportation of bones, etc. will be subject to a duty of $8 per 1000 kg., and should necessity arise the exportation of such articles may be prohibited. The annual exportation of bones, etc. from Uruguay is estimated at 12 million kg. and the requirements of superphosphates at over 100 million kg. for agricultural purposes; it is therefore considered to be in the interests of the country to limit the exportation of ingredients needed for the manufacture of superphosphates.

Power Alcohol in Pernambuco.—The high price of gasoline in Pernambuco, Brazil, has attracted attention to the possibility of replacing it by alcohol, which is very plentiful locally and is made by most of the sugar-mills. The total production is not known but over 9,189,000 litres was exported during the year ended August, 1919. Greatly increased supplies could also be obtained were the bagasse utilised instead of being burned as fuel, for it may contain as much as half the original sugar content of the cane. Pure alcohol of 41—42° was found to be a satisfactory fuel for automobile engines; the consumption and power developed are practically the same as with petrol, and very little deposit is formed in the cylinders. All that is necessary when using alcohol is to replace the cork carburettor-float by a metal one, and to mix the alcohol with 5 per cent. of gasoline or kerosene to prevent the slight internal rusting that would otherwise ensue. Alcohol mixed with 5 per cent. of kerosene has the further advantage of being exempt from the stamp tax and can be sold locally at only 40 per cent. of the price of gasoline.—(*U.S. Com. Rep.*, *Mar.* 15, 1921.)

The Paint and Varnish Industry in Argentina.—Although paint and varnish factories were established in Buenos Ayres more than 35 years ago, only the cheaper grades of paint are manufactured; plenty of linseed oil is available locally, but white and red lead, lithopone, barium sulphate, dry colours, etc. are almost exclusively imported. Until 1914 Germany supplied most of the white lead, but now about 95 per cent. of it comes from the United States; 556 metric tons was imported in 1919; efforts are being made to produce it in the country, but the equipment of the factories is mostly poor and manufacturers cannot compete with foreign producers. Of other lead compounds the only one used to any extent is red lead, of which 503 t. was imported in 1919, mainly from the United States. Zinc oxide, free from lead, is being used in increasing quantities, but lithopone has been little employed, although it would probably be in greater demand if it were available at a reasonable price. Barytes is used in much larger quantities than white lead, the imports in 1919 being blanc fixe, 54 t., barytes, 1237 t. Dry colours are largely obtained from Europe, the imports and chief sources in 1919 being as follows:—Dry colours, 1873 t. (U.K. 34%, Spain 31%); ultramarine blue and green, 938 t. (U.K. 93%); Prussian blue, 11 t. (U.K. 54%). Benzene and turpentine came mainly from the United States, gums and resins are from England. One of the principal dryers used is manganese borate, the best quality of which is obtained from Germany. The Argentine industry will probably continue to make only paints of medium or low quality.—(*U.S. Com. Rep.*, *Apr.* 4, 1921.)

Kapok in the Dutch East Indies.—Kapok is produced in the Dutch East Indies on 134 estates, mainly in central and eastern Java, which supply seven-eighths of the total export. The product is usually classified according to the content of seeds and dirt, and marked with the name of the district of origin. Kapok has been in good demand for many years from America, Europe, and Australia for use in the stuffing of mattresses, bandages, spinning, and in the manufacture of felt and guncotton. The United States is the largest consumer, and requires products of the first quality only, medium grades going to Europe and the lowest to Australia. Exports during recent years have been as follows:—1913, 10,145 metric tons; 1917, 11,939 t.; 1918, 9031 t.; 1919 (Java and Madura only), 17,082 t.—(*U.S. Com. Rep.*, *April* 12, 1921.)

Reported Petroleum Discovery in Manchuria.—According to the *Far Eastern Review*, petroleum has been discovered in the Hinsun Mountain, north Manchuria. The oil is to be worked privately under Government supervision, American technologists are to be engaged, and American machinery has been ordered.—(*U.S. Com. Rep.*, *Apr.* 4, 1921.)

PERSONALIA.

Prof. J. W. Nicholson has been elected president of the Röntgen Society.

Mr. F. S. Edie, lecturer in biochemistry in the University of Aberdeen since 1911, has been appointed to the chair of biochemistry in the University of Cape Town. Mr. Edie worked for some years in the Biochemistry Department of Liverpool University, and subsequently spent 18 months at Khartum, where he did research work connected with the gum industry of the Sudan.

Prof. E. Abderhalden, professor of physiology in the University of Halle, has been called to the chair of physiology in the University of Basle, vacant by the death of Prof. G. von Bunge. Dr. E. Wilke-Dörfurt, of the Siemens-Halske A.-G., has been appointed to succeed Prof. W. Biltz as professor of chemistry at the School of Mines, Clausthal. Dr. H. Fühner, of the University of Königsberg, has been appointed to succeed Prof. Boehm in the chair of pharmacology in the University of Leipzig. Dr. Stiasny, of Vienna, has been offered the directorship of the new Institute for the Chemistry of Tannins at the Technical "Hochschule," Darmstadt.

From the United States the deaths are announced of Mr. W. B. Cogswell, aged 87, the founder of the Solvay Process Co., and a member of the Society of Chemical Industry since 1884; and of Mr. G. Sawyer Dyer, a well-known sugar chemist.

PARLIAMENTARY NEWS.

HOUSE OF COMMONS.

Phosphate Deposits on Ocean and Nauru Islands.

Replying to Mr. Ormsby-Gore, Sir A. Boscawen stated that the commissioners appointed to dispose of the phosphate deposits on Ocean and Nauru Islands were Mr. A. B. Dickinson (H.M. Government representative), Mr. H. B. Pope (Australian Government), and Mr. A. F. Ellis (New Zealand Government). The commissioners and not the Ministry of Agriculture were responsible for selling the phosphate. No data as to the tonnage available or the methods of marketing the phosphate in England were at hand, but a mixture of ground Nauru phosphate and basic slag was being placed on the market by the Slag Phosphate Co. at approximately 3s. per phosphatic unit, which compared with the following prices per unit of other phosphatic fertilisers free to nearest station:—Superphosphate: 30 per cent. soluble phosphate of lime, 5s. 6d., 35 per cent. soluble, 5s. 4½d.; Bilston basic slag, 30 per cent. total phosphates, 4s. 5d.—(June 22.)

Prices of Foreign Coal.

Sir P. Lloyd-Greame, answering Sir W. de Frece, gave the following representative prices for coal in the United States, France, Belgium, and Germany, converted at the average rate of exchange in London, for the periods mentioned:—*United States*, April, 1921: Anthracite, stove, 37s. 9d.—41s. 6d. per ton f.o.r. mine; bituminous "run of mine," Fairmont, W. Virginia, 9s. 6d.—11s. 6d. per ton f.o.r. mine. *France*, June, 1921: In the Nord and Pas de Calais districts, 30s.—60s. per ton f.o.r. mine according to grade; a representative "run of mine" grade was quoted at 38s. *Belgium*, June, 1921: In the Mons district, 28s. 6d.—51s. per ton according to grade; a representative "run of mine" grade 40 per cent. large was quoted at 39s. *Germany*, May, 1921: Official maximum prices of the National Coal Union for Rhenish Westphalia were anthracite best nuts 21s. 6d. per ton, gas coal 21s. 6d., and factory coal 23s. 8d. per ton.—(June 23.)

United States Import Restrictions.

Replying to Captain W. Benn, Mr. Baldwin stated that the import of oxalic and formic acids into the United States was prohibited, except under licence, as a war measure in February, 1918, and the prohibition had recently been continued for three months by the Emergency Tariff Act. Prices in 1918 were much higher than they were at present.—(June 23.)

Imports of Coal.

Mr. Bridgeman, in reply to Mr. Gilbert, stated that the following quantities of coal had been imported into the United Kingdom since April 1:—United States, 335,000 tons; France, 430,000 t.; Belgium, 495,000 t. About 160,000 t. of German coal was included in the imports from France and Belgium.—(June 27.)

Optical Glass.

Replying to Major Barnes, Sir P Lloyd-Greame stated that optical glass is now manufactured in the United Kingdom by three companies, but the exact amount of capital invested in the industry could not be determined as two of the three firms were carrying on the manufacture as a part only of their operations; during the war it was estimated at rather more than £150,000. The manufacture of optical glass had been carried on at a loss since the armistice. The Government had assisted the industry to the extent of about £78,000 since August, 1914.—(June 27.)

Oil-Fuel on Railways.

In answer to Mr. Percy, Mr. Chamberlain said that 116 locomotives had been fitted with oil-burning apparatus and another seven were being adapted. Sufficient experience had not yet been obtained to enable the relative efficiency and cost of oil and coal to be determined.—(June 27.)

Sugar Imports.

Answering Mr. G. Murray, who inquired if the Board of Trade was aware that competition from foreign sugar sold in the United Kingdom below the cost of production was acting as a deterrent to the development of our overseas sugar industry, Mr. Baldwin said that he could not give an assurance that the Government would take special measures to penalise imports of cheap sugar; sugar of Empire origin already enjoyed a substantial preference of about ½d. per lb. over foreign sugar on importation into this country.—(June 28.)

The Coal Strike: Terms of Settlement.

The Prime Minister announced that an agreement had been arrived at between the Miners' Executive, the Mineowners' Association, and tho Government, by which the demand of the miners for a national wages' pool had been abandoned, and that a new system would be introduced whereby the proceeds of the industry would be shared between the workers and the employers. There would be a standard minimum wage at the rate of 20 per cent. above the pre-war rate; after deducting the other costs of production, the owners would receive a standard profit equivalent to 17 per cent. of the sum paid as standard wages; and any further proceeds would be divided in the proportion of £83 to the worker and £17 to the owner. The reductions in wages would be spread over July to September, and Government aid would be given up to a maximum of £10,000,000 for that period. In any district where such aid was necessary, the owners had agreed to forego any profit that would accrue to that district under the profit-sharing scheme. A National Board would be set up, consisting of equal numbers of representatives of the mineowners and miners, and also District Boards of a like character, to which all matters of controversy between the parties would be referred. The agreement would endure until September 30, 1922, and thereafter until terminated by three months' notice on either side.—(June 28.)

Safeguarding of Industries Bill.

This Bill was considered in Committee on June 29, 30; among a number of amendments proposed and rejected were the following:—To postpone the operation of the Bill until January, 1922; to exempt from duty under Part II. articles which had paid the 33 per cent. duty under Part I.; to omit the paragraph of Clause 2, Pt. II. dealing with dumping due to the effect of collapsed exchanges; and to extend the scope of the inquiry into the effect of dumping on unemployment so as to include the aggregate of employment in the whole country.

Electric Glow-lamps.

Mr. Hannon asked the President of the Board of Trade if it were true that the registered imports into this country of electric glow-lamps from January to April, 1921, inclusive, were nearly one million, that the number of gas-filled lamps had increased from 87,272 in January to 224,519 in April, and that 129,097 vacuum lamps had been imported during April. In admitting the accuracy of these figures, Sir P. Lloyd-Greame stated that the exports of electric glow-lamps for the four months named had amounted to 2,426,000; he regretted that some of the electric-lamp factories were closed and that others were on short time.—(July 5.)

Prices of Reparation Dyestuffs.

In reply to Sir W. Barton, Sir P. Lloyd-Greame said that there was no reason to think that there was any general divergence between the prices of German reparation dyestuffs and those charged by Germany to customers in other countries, or that the prices charged were retarding the recovery of the British textile trade. The prices charged by the Board of Trade for reparation dyes were fixed and revised from time to time to meet market conditions by the Trade Licensing Committee, which included representatives of the consumers nominated by the Colour Users' Association. He was not aware that the majority of these representatives had repudiated having been consulted, or that they had disapproved of what had been done.—(July 5.)

LEGAL INTELLIGENCE.

THE VALIDITY OF TRADE NAMES.

It will be remembered that in 1915 the trade name "Aspirin" was removed from the British Trade-Mark Register under the provisions of the Patents, Designs, and Trade Marks (Temporary Rules) Act, 1914, and as a consequence the name "Aspirin" is now public property in this country.

It has been held recently in the United States District Court for the Southern District of New York, in an action between The Bayer Company Inc. of New York, and the United Drug Company of Boston, that "Aspirin" is a valid trade mark within the realms of pharmacy and medicine, but not in the relation of the public to the tablet form of acetysalicylic acid. In deciding the issue the Judge stated that acetylsalicylic acid is known as such to manufacturing chemists, pharmacists, and physicians, and that to these persons "Aspirin" must be held to signify only the product issued by The Bayer Company, but on the other hand the name "acetylsalicylic acid" is practically unkown to the public, though the name "Aspirin" is in common usage. In the circumstance, the Court ruled that a pharmacist is justified in supplying any reputable form of acetylsalicylic acid tablets to a layman who asks for "Aspirin," but when a physician writes "Aspirin" in a prescription, it must be assumed that he does so with full knowledge of all the facts, and that in such cases only The Bayer Company's product should be supplied.

The ruling seems to be one of considerable interest and importance in view of the attempt now being made in several directions by German manufacturers to push their products in various markets.

A common-sense view of the use of trade-names is given in a small publication entitled "The B.D.H. Guide to the B.P., 1914," from which the following remarks have been taken:—

"The number of synthetic remedies which receive official rank for the first time is perhaps surprisingly small. The medical and pharmaceutical professions should welcome heartily the cases—all too few—in which chemical substances have been introduced into the Pharmacopœia under specially-coined names. It is clearly in the interests of prescribers and patients, as well as of wholesale and retail chemists, that the official name should in every case become popularised and used by medical men, pharmacists and the public, to the exclusion of all synonyms, whether registered trade marks or otherwise.

"An enterprising firm which discovers a new drug is fully entitled to the fruits of such enterprise, and to an adequate return for money laid out in effecting and exploiting the discovery. Beyond the satisfaction of such legitimate rights, the branding with special or proprietary names of well-known chemical substances is to be deprecated as being an intolerable nuisance to medical men and pharmacists, and an unjustifiable tax upon patients who are called upon to pay an inflated price for the drug. To take one instance, acetylsalicylic acid has received at least half-a-dozen trade names; it is now a pharmacopœial substance, and it would seem as if an opportunity had been missed in not coining for this drug a short euphonious official synonym which could have been utilised in place of all other names (the official abbreviation 'acid acetylsal.' is useless for this purpose). The course which has been successfully followed with barbitone and hexamine could have been extended to acetylsalicylic acid with considerable advantage."

REPORTS.

General Report on the Economic, Financial and Industrial Conditions of the Netherlands, January, 1921. *By* R. V. Laming, *Commercial Secretary to H.M. Legation, The Hague. Department of Overseas Trade.* Pp. 43. *London: H.M. Stationery Office.* 1921. *Price* 1s. 3d.

During the first nine months of 1920 trade and industry in Holland were at the normal pre-war level. Many industries complained of high costs of production as compared with costs in Germany, although they were lower than corresponding costs in England and America. The introduction of the 8-hour day upset calculations, but better supplies of fuel and raw materials at slightly lower prices were favourable factors. At the beginning of the year the margarine industry declined, but increased prosperity was reported thereafter. The leather industry was in sore straits and the greatest difficulty was experienced in keeping factories working. Conditions in the paper and allied industries were unsatisfactory. The slump which occurred in the autumn plunged practically every industry into difficulties; not only was there no outlet for finished products, but in many cases, *e.g.*, in the textile industry, holders of stocks incurred heavy losses owing to the unprecedented fall in the prices of raw materials.

Preliminary reports indicate that results in agriculture were unsatisfactory on the whole. In the sugar industry the large profits made at the beginning of the year were neutralised to some extent by the subsequent fall in prices; but as the Dutch sugar interests are combined under the Central Sugar Association and large forward sales are said to have been made, considerable profits will probably result.

The output of coal during the first 10 months of 1920 was 3,216,000 tons, or 393,000 t. more than in the corresponding period of 1919. For the whole year the estimated output is 4 million t., and as the mines are being steadily developed it is hoped to obtain 6 million t. in 1925, and 7—7·5 million t. in 1930. At present hard coal is being mainly produced, of which the maximum output is placed at 3 million t. yearly. The total minimum requirement of coal is estimated at 7·8 million t. Lignite-mining has decreased since coal has been in better supply; reserves of lignite in sight are estimated to be sufficient to last 5—10 years. Over 21,000 t. of salt was produced in the first 10 months of the year, but the prospects of the Boekelo mine are not bright as German salt is selling below the cost of production in Holland; however, the mine will probably be worked at all costs as the Government is financially interested in it.

Imports were valued at 3,367,471,675 and 1,748,513,401 gulden, but the large adverse balance is reduced to 435 million gulden if profits from freightage, transit trade, receipts from the colonies, etc. be included (gulden = 1s. 8d.). Imports and exports in 1920 included:—

	Imports.	Exports.
	Metric tons.	
Minerals, metals and manufactures of	7,939,867	967,196
Chemicals, drugs, dyes and colours	177,141	59,995
Oils, resins, wax, pitch, tar and manufactures of tar	719,144	191,334
Hides, skins, leather-ware	23,792	22,553
Earthenware, porcelain, pottery, stoneware, etc.	666,414	82,940
Glass	34,848	56,995
Paper	84,602	225,660

Holland exported to the United Kingdom goods valued at £39,292,000 and imported goods worth £62,375,000, representing 22 and 19 per cent., respectively, of the total values to and from all countries. Germany and the United States are our chief competitors, and British firms are urged to make firm quotations and to guarantee deliveries in order to maintain their position.

REPORT ON THE ECONOMIC AND FINANCIAL SITUATION OF EGYPT IN 1920. *By* E. H. MULOCK. *H.M. Commercial Agent, Cairo. Department of Overseas Trade. London: H.M. Stationery Office*, 1921. *Price* 1*s. net.*

The year 1920 was in many ways a remarkable one in the economic history of Egypt, owing to the many crises, the deadlock in the internal movement of imported manufactures, and the wild speculation in cotton and land. So acute had become the cotton crisis, induced by an enormous fall in prices, that the area under the crop had to be compulsorily restricted to one-third of each cultivator's holding. During the early part of the year the imports, particularly those from the United Kingdom, were so heavy and the prices so high that the consignees in many cases left the goods in the bonded warehouses, which soon became overstocked. The imports were valued at £E101,880,963, an increase of £E54,471,246 over 1919 (£E = £1 0s. 6.15d. at par), the chief items, together with the percentage increases over 1919, being:—Hides, skins and leather goods, £E1,602,519 (110); oils, spirits and beverages, £E5,947,634 (40); coal and wood, £E11,993,427 (206); earthenware, glassware, £E1,933,695 (249); dyestuffs, colours, tanstuffs, £E883,570 (28); chemicals, medicines, perfumes, £E5,531,302 (65); metals and wares thereof, £E11,842,261 (22). Of the total imports the United Kingdom supplied 37 per cent. and the United States 10 per cent. That German competition is growing is shown by the increase in the proportion of imports of German origin from 0·01 per cent. in 1919 to 1·16 per cent. in 1920. German glass and chinaware, drugs (*e.g.*, saccharin, aspirin, odol), and coal-tar dyes have reappeared on the market in large quantities. The value of the synthetic indigo and other coal-tar dyes imported was nearly treble and the quantity double that of similar imports from the U.K. The imports also include a large quantity of petroleum products, as the Egyptian production (231,919 metric tons of crude oil in 1920) is insufficient for the country's requirements in kerosene and *mazout* (oil-fuel).

The total exports from Egypt in 1920 were valued at £E85,467,061, as against £E75,888,321 in 1919, the increases being almost entirely due to the enhanced prices of raw cotton; but many categories of exports show decreases which in some cases were compensated for by increased values (cottonseed, sugar, phosphate, etc.). The bulk of the phosphate exported (145,000 metric tons) was taken by Japan, Italy, Australia, and New Zealand, and the greater part of the superphosphates imported (13,770 t.) came from Belgium. The manufacture of superphosphate could be undertaken if cheap sulphuric acid were obtainable.

SAND-LIME AND OTHER CONCRETE BRICKS. *By* H. O. WELLER, *Director of Building Research. Special Report No.* 1 *of the Building Research Board. Department of Scientific and Industrial Research. Pp.* 11. *H.M. Stationery Office*, 1921. *Price* 3*d.*

This pamphlet is divided into two sections, of which the first deals with sand-lime bricks and the second with cement-concrete bricks. Sand-lime bricks are made by mixing any clean silicious sand or suitably graded slag, clinker, etc. with from 5 to 10 per cent. of lime, which must be completely slaked before use. Enough water is added to make the mixture cohere when clutched in the hand. The bricks are tamped or pressed and finally hardened by subjecting to steam at a pressure of 100 lb. per sq. in. for 8—10 hours. The bricks are white, cream or grey in colour, of good shape, and their crushing strength may reach 700 tons per sq. ft. They can replace ordinary burnt-clay bricks for most purposes, and also be used instead of white-glazed bricks; their resistance to acid fumes makes them very suitable for use in chemical works and chimney stacks. Whereas a bad sand-lime brick deteriorates on exposure to damp, a good brick improves with age under similar conditions. A good sand-lime brick consists of calcium silicate, but a bad one is merely a mixture of calcium carbonate and sand. Unfortunately the good and bad bricks are not easily distinguished by simple tests, and a standard specification would be useful. The bricks made from granulated blast-furnace slag are the cheapest, and are ready for use after subjecting to live steam without pressure or even by merely exposing to the atmosphere for some time. Ground slag, however, is often an excellent cement in itself, so that these bricks are not true sand-lime bricks.

Cement-concrete bricks are made from a "semi-dry" mixture of Portland cement with sand or other aggregate. A new method has been patented for using any earth burnt at 1500° C. as an aggregate with cement, but it is obvious that there must be serious difficulties in the incineration of some earths. The ratio of cement to aggregate should not as a rule fall below 1:6 if the bricks are hand-made, or 1:9 if they are power tamped. The manufacture is simple, and is essentially one for the builder. A small plant for an output of 1000 bricks a day costs about £8; large plants cost from £250 to £800. After pressing the bricks are sprinkled with water twice a day for a fortnight, when they are ready for use. Exposure to steam in a closed vessel for 24 hours gives the same result, but steaming for 48 hours imparts a maturity which usually takes three months to attain. The bricks continue to harden for years. The concrete may be modified to suit special circumstances. Pigments may be added if an attractive surface be desired, but better results are obtained by using a selected sand for the facing bricks. If a hard-wearing surface be required the bricks may be built up in moulds with a face of granite chips or other vitreous aggregate. In bricks which are to be exposed to sea water the Portland cement may be replaced by a slag cement. The estimated cost of these bricks is from £2 4s. to £2 10s. per thousand.

OFFICIAL TRADE INTELLIGENCE.

(*From the Board of Trade Journal for June* 23, 30, *and July* 7.)

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W. 1, from firms, agents or individuals who desire to represent U.K. manufacturers or exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department and quoting the specific reference number.

Locality of firm or agent.	Materials.	Reference number.
Australia	Pharmaceutical preparations ..	*412/20/7/628
,, ...	Pottery, glassware	*
,, ...	Signal illuminating oil (tender for)	34,139
British East Africa	China, glassware	12
British West Indies	Cement, white lead, red lead, galvanised tubes, glassware ..	737
Canada	Chemicals, zinc oxide, manganese, potassium and lead salts, red lead, soda salts, lithopone, barytes, sulphur, whiting, French chalk, coal-tar products and intermediates	759
,, ...	Paper-mill stock	†
,, ...	Soap, salt, white lead, galvanised sheets	4
,, ...	Paint	7
,, ...	Alum, sulphites, china clay, and paper-making supplies ..	11
France	Sodium sulphate and bichromate	767
Poland	Metals	19
Iceland	Earthenware	769
Spain	Rubber wares	752
Colombia	Sugar-milling plant	773

* The Official Secretary, Commercial Bureau, Australia House, Strand, London, W.C. 2.

† The Canadian Government Trade Commissioner, 73, Basinghall Street, London, E.C. 2.

TARIFF. CUSTOMS. EXCISE.

Antigua.—A copy of a Bill to give effect to the Canada-West Indies Agreement of June, 1920, in so far as it applies to Antigua may be seen at the Department.

Australia.—High-grade carbon sheets and alloy steels containing alloying elements as prescribed by departmental by-laws pay duty at the rate of 20 per cent. *ad valorem* under the British preferential tariff. Other customs decisions affect aluminium, nickel, iron and steel pipes, brazing and soldering alloys, incandescent mantles, linseed oil, castor oil, varnish, earthenware, china, porcelain, glass lenses, glass bottle-marbles, dry gums, glue, and gelatin.

Austria.—Articles in respect of which import permits are granted without special application, on payment of a "manipulation" fee, include photographic papers, glass, glassware, china, earthenware, various metal goods, chemicals (with certain exceptions), and prepared drugs, except saccharin, morphine, cocaine, opium, etc.

Export licences are no longer required for chalk, articles made of magnesite, common salt, pig iron, various chemicals, and prepared drugs, with certain exceptions for which special licences are required.

Belgium.—The revised consumption duties on alcoholic beverages came into force on July 1. "The coefficients of increase" on malt, machine belting, and toilet soap have been reduced.

Esthonia.—Export licences are not required for cement, cement and earthenware manufactures, ergot of rye, certain leather products, chemicals (except perfumery), wood tar, iron and steel scrap, cellulose, matches, broken glass, etc.

Federated Malay States.—The import duties on alcoholic beverages have been amended.

Fiji.—The import of opium is prohibited, except on behalf of registered physicians, dentists, druggists, etc.

France.—The taxation on acetic acid and vinegar has been modified. The tax must be paid on imported acid and vinegar in addition to the customs duty. For the purpose of this duty 100 kg. of acetic anhydride is considered equivalent to 117 kg. of crystallisable acid. Acetic acid for export is free from tax.

France and Algeria.—The customs duties on oil-cake and other cake, suspended in August, 1914, have been re-established.

"Coefficients of increase" are now applied to various cereal and sugar products.

Germany.—A permit is not required for oleomargarine when imported from the occupied German territory.

Germany (Occupied Territory).—Import licences are not required for petroleum, fatty oils, various fibres, etc.

Gold Coast.—The Regulations governing the importation of spirits are set out in the issue for July 7.

Italy.—Export licences are no longer required for aluminium, brass and bronze scrap, lead and zinc ores, lignite, olive oil and manufactures of, tin dross, edible oils.

The import prohibitions previously affecting United Kingdom goods have been abolished, except as regards dyes and dyestuffs, which still require an import licence.

Japan.—The manufacture, sale, import, and transport of matches containing white phosphorus have been prohibited as from July 1, 1922.

Mexico.—A surcharge of 10 per cent. *ad valorem* has been levied on imported spirits.

The export duty on vanilla has been withdrawn as from May 30.

Morocco (French Zone).—Phosphates may now be exported without restriction as to quantity or price.

Newfoundland.—It is proposed to increase the special war surtax on all articles (with a few exceptions) by 10—25 per cent. of the duty payable.

Norway.—The prohibition of the import of chocolate and confectionery is still in force.

Peru.—The consumption duty on alcoholic beverages has been increased.

Poland.—As from June 8, 150 paper marks must be paid for each gold mark leviable under the customs tariff on porcelain wares, perfumery, toilet and medicinal soap, manufactures of gold, silver, copper, and tin, cinematograph films, etc.

Sierra Leone.—Recent customs decisions affect salt, corrugated iron sheets, and lumber.

Switzerland.—The new provisional customs tariff is issued as a supplement to the issue of June 30. The new duties are generally much higher than previous duties, and many articles formerly duty free are now subject to duty.

Import duties affect cocoa, sugar, edible oils, margarine, yeast, alcoholic beverages, horns, hides, skins, oil cake, paper pulp, paper, board, vegetable fibres, rubber, gutta percha, clay, lime, cement, stones, asbestos, mica, earthenware, pottery, glass, glassware, many metals and ores, chemicals, drugs, colours, dyes, mineral oils, industrial oils, soap, polish, incandescent mantles, inks, and sealing wax.

Export duties are payable on scrap iron, old copper and brass, rags, waste paper, bones, and raw hides and skins.

The export of matches made with white phosphorus is prohibited.

Trinidad and Tobago.—The export duties on syrup and molasses have been reduced.

Tunis.—The prohibition of the export of soaps, except scented soap, has been withdrawn.

GOVERNMENT ORDERS AND NOTICES.

EXPORT RESTRICTIONS.—*Fuel.*—The Board of Trade (Licensing Section) has announced that as from July 4, 1921, the restrictions on the export of coal, coke, and manufactured fuel have been removed.

Dangerous Drugs.—The Home Secretary has given notice that licences for the export of drugs to which the Dangerous Drugs Act applies are now issued by the Home Office, instead of by the Board of Trade. Applications for licences should be made on the Board of Trade Application Form A, and should be sent, together with the fee of 2s. 6d. for each licence, to the Under-Secretary of State (Accounts Branch), Home Office, Whitehall, S.W. 1.

The following is a list of the drugs to which the Act applies and for which licences are required:—Raw opium, medicinal opium, morphine, cocaine, ecgonine, and diamorphine (heroin), and their respective salts, and any preparation, admixture, extract, or other substance containing not less than one-fifth per cent. of morphine or one-tenth per cent. of cocaine, ecgonine or diamorphine (heroin).

TRADE NOTES.

BRITISH.

Trinidad and Tobago in 1919.—Although trade was still adversely affected by conditions arising out of the war, the Colony continued to make marked progress in 1919. The cultivation of cocoa, which is considered to offer the most lucrative opening to capital, made further headway and the export in 1919 (*c.f.i.*) was about 2700 t. above the average of the previous 10 years. The sugar crop was only slightly greater than that of 1918, the lowest for many years, and stress is laid on the need for improved methods of cultivation; manufacturers' profits have been very large during the past four years. Coconut cultivation is rapidly extending, new areas are being planted up, and there should be a rapid increase in output in a few years' time; the export of nuts and copra was somewhat smaller than in 1917 and 1918, owing, perhaps, to a larger local consumption. Experiments conducted by the Department of Agriculture have shown that *Hevea Brasiliensis* gives good average yields of rubber even in areas too dry or windy for successful cacao cultivation; 41,039 lb. of rubber, mostly Hevea, was exported (approx. 36,539 lb. in 1918, and 5492 lb. in 1914). Owing to attacks of fungus disease, the lime crop was poor, and exports of lime juice declined from 24,419 galls. in 1918 to 19,479 galls. in 1919; cultivation, however, is being extended both in Trinidad and Tobago. Fibre cultivation for the manufacture of pulp for paper will probably be a prominent feature among coming agricultural industries. The petroleum industry made very good progress; there were at Dec. 31, 1919, 13 producing companies and 463 wells, of which 273 were on Crown Lands. The production was 64,436,632 imp. galls., or 8,435,766 galls. less than in 1918.

Exports were valued at £6,293,486, and the principal items were:—Asphalt and manjak, 66,574 t.; cocoa, 27,117 t.; coconuts, 30,900,424 nuts; copra, 801 t.; molasses, 363,089 galls.; sugar, 37,805 t.; petroleum, crude, 44,681,107 galls.; petroleum spirit, 2,419,744 galls. Of the imports, valued at £5,254,126, the United Kingdom supplied 16·7, Canada 20·5 and the United States 39·1 per cent. The United Kingdom took 38·8 per cent. of the exports, the United States 28·3, and France 15·7 per cent.—(*Col. Rep.-Ann., No.* 1069, *Mar.*, 1921.)

Sulphate of Ammonia Prices.—The British Sulphate of Ammonia Federation, Ltd., has fixed prices for sulphate of ammonia for home agricultural use for July–August as follows:—£14 6s. per ton for dry neutral quality, basis 25·75% NH_3; £13 3s. per ton for ordinary quality, basis 25·25% NH_3. Before the war the basis was 24% NH_3.

FOREIGN.

Trade of Belgium in 1920.—Despite the world-wide economic depression, Belgian trade in 1920 was on the whole quite satisfactory. With the exception of the iron and steel industry, practically every works in the country was working at full capacity, the production of coal and glass exceeded that of any preceding period, and there was little labour unrest. The imports during the year amounted to 11,946,448 metric tons, valued at 11,171,467,474 fr., and the exports to 11,548,593 t., worth 8,708,081,535 fr. The chief imports and exports are given below:—

	Imports.	Exports.
	Metric tons.	
Margarine, and other butter substitutes	12,877	5,026
Sugar, syrups and molasses, all kinds	2,424	73,329
Olive oil	577	133
Groundnut oil	1,152	772
Salt	221,423	524
Acetic acid and vinegar	386	47
Fats, non-edible	7,202	4,778
Fats, edible	3,988	9,086
Wax, crude	449	381
Copper ores	54,089	10,334
Tin ores	361	251
Iron ores	2,419,011	152,809
Manganese ores	177,169	160,303
Lead ores	30,488	2,390
Zinc ores	261 984	20,070
Ores, other	9,092	6,801
Aluminium metal	415	68
Copper, crude	25,144	18,064
Tin, crude	1,969	74
Iron and steel	859,196	98,799
Tinplate	11,214	904
Coal, coke, briquettes	1,816,518	2,070,011
Coal tar and pitch	301,408	20,272
Petroleum, crude and refined	79,539	27,376
Oils, other	174,807	73,298
Bitumen	8,659	1,299
Sulphur	6,153	3,577
Lime	3,404	1,123,146
Cement	2,921	749,489
Basic slag	31,009	186,995
Superphosphate of lime	4,216	150,637
Dyewoods	1,853	39,194
Bark, tanning	1,743	5,136
Wood pulp	114,532	15,682
Copra and dried coconut, non-edible	2,646	748
Palm nuts	1,309	1,704
Soap and candles	3,799	4,469
Perfumery	338	26
Carbon dioxide, liquid	659	7
Sulphuric ether	1,608	40
Sodium carbonate	20,287	4,169
Sodium nitrate	81,858	4,634
Sodium sulphate	41,218	5,122
Sodium sulphite	1,120	78
Ammonium sulphate	5,129	522
Chemicals, other	221,469	335,325
Coconut oil	10,218	6,473
Cottonseed oil	1,410	541
Flaxseed oil	1,874	7,310
Palm oil	3,417	2,398
Castor oil	190	467
Oils, other vegetable	6,591	9,096
Indigo	264	126
Dyes and colours, other (except dyewoods)	38,682	34,627
Glassware, all kinds	11,599	256,189
Starch, all kinds	4,007	6,443
Isinglass and glue	1,264	3,721

The percentage distribution of the imports into Belgium was:—France 22·3, Germany 17·8, United Kingdom 11·3, and the United States 7·8; and that of the exports from Belgium:—France 42·9, Holland 17·3, U.K. 8·5, and Germany 5·3.—(*U.S. Com. Rep., May* 11, 1921.)

The Nitrate Situation.—Messrs. Aikman (London), Ltd., in their half-yearly report on the nitrate situation, refer to the adverse effect of general trade conditions upon the sale of nitrogenous fertilisers, of which the consumption has fallen off everywhere except in Germany. Total stocks are now estimated at 2,431,000 tons, against 1,800,000 t. a year ago, and of this total some 1,480,000 t. will probably be available for next season's consumption. In the year ended June 30 about 1,434,000 t. was consumed, or 448,000 t. less than in 1919–20. Owing to the present abnormal conditions, the monthly production has fallen from an average of about 210,000 t. a year ago to 100,000, many oficinas have been closed down, and the situation is viewed with the greatest gravity by the Chilean Government, as already some 40,000 men are idle in the nitrate districts. Production costs have fallen and are now estimated at 6s.—8s. per quintal (quintal=101·6 lb.), a few isolated cases excepted. The producing companies are said to be in a strong position financially owing to previous sales at high prices; but the future is uncertain, although if the price could be fixed at about £15 per ton the margin of profit would be ample.

The question of stabilising prices was discussed at a recent international conference held at Rotterdam. As a temporary measure the German Nitrogen Syndicate offered to abstain from exporting nitrate or sulphate of ammonia and not to increase its plants for six months, provided that other nitrogen manufacturers would agree to maintain prices at a reasonable level and not to dump their materials into Germany at prices below the world's market prices; on these conditions no steps would be taken to prevent the importation of Chilean nitrate into Germany. The question was also discussed of initiating a system of international credit by which agriculturalists could be given credit up to 50 per cent. of their purchases until their crops were harvested.

REVIEWS.

A Dictionary of Applied Chemistry. *By* Sir Edward Thorpe. *Assisted by Eminent Contributors. Revised and enlarged edition.* Vol. 1, A—Calcium. *Pp. viii+752. (London: Longmans, Green and Co.* 1921.) *Price* 60s. *net.*

The reception that Sir Edward Thorpe's monumental work has met with during the 31 years in which its several editions have been before the public gives it an all-sufficient testimonial and renders unnecessary any praise which a reviewer can bestow on it, even assuming he had the temerity to take up such an attitude. The first volume of the last edition of the work was published in 1912, and it augurs well for British chemical industry that another edition is demanded so soon. Moreover, it would appear from a statement in the preface, to wit, that the publication of the edition has been delayed by circumstances arising out of the Great War, that this demand is one dating some time back. The volume is about the same size as its immediate predecessor, but the subject-matter dealt with in the last page reached only to p. 614 in Vol. I. of the previous edition, a rate of increase of over 6 per cent.

In attempting to criticise this work the reviewer has regarded it, not as an exhaustive treatise on Manufacturing Chemistry—the compilation of which is nowadays well-nigh impossible—but as a series of articles on subjects of concern to the manufacturer, written by acknowledged experts and giving complete references to original papers.

It is too much to expect that all the articles should conform uniformly with this thesis, yet unquestionably the majority of those in the present volume conform with it; and what is an extremely important point in a work of the kind, the articles as a whole are uniform.

Some of the chief articles will now be referred to *seriatim*. Acetic acid, including vinegar manufacture, has been brought up to date. In this article it is surprising to find under Manufacture of Acetic Acid from Acetylene, French patents and not the corresponding English patents quoted. No mention is made of the Schidrowitz method of estimating mineral acid in vinegar (*cf.* J., 1903, 1018). Acetone, from the manufacturer's point of view, is treated meagrely, and although it was difficult during and immediately after the war to obtain details, this has not been the case for the last two years. It might therefore have been expected that some mention would be made of the production of acetone from acetylene. The biochemical process of producing acetone has not been quite a success, yet since the process has been used commercially it certainly deserves more than five lines of text. The table giving the sensitiveness of indicators should have been extended to include indicators introduced within recent years, and the range of hydrogen-ion concentration corresponding with the sensitive point of each should have been given. Considering the importance of alcohol in chemical manufacturing and for power purposes, an article covering 5½ pages of text is certainly inadequate; the article seems to have been but little altered from that published in the last edition of the Dictionary.

"Alizarin and Allied Colouring Matters" is much enlarged. A short article dealing generally with alkaloids is a new feature of the present volume. Under ammonia a succinct account is given of modern synthetic processes. The article on Analysis, covering 104 pages, has been brought up to date, and is certainly an excellent contribution. Almost what might be called a treatise on the subject, it errs perhaps in being somewhat long for the Dictionary, where an article on the subject might be expected to contain general principles rather than details. However, the numerous well-chosen references enhance its value considerably. The article on Animal Charcoal has been omitted from the present volume. Perhaps it is intended to deal with the subject later on under sugar, or under decolorising carbons, which is in itself an important industry.

The article on anthocyanins is a welcome addition, and its value is the greater from the fact that it is written by one of Willstätter's collaborators on this subject. In the article on arsenic the Marsh test is dealt with but briefly, and it is surprising to find no reference to the work carried out in this country on the detection and estimation of minute traces of arsenic by the Marsh method in which Sir Edward Thorpe himself took so large a part. An addendum to the article on the Balance, "highly refined weighing," deserves mention. It is not generally known that Barreswil was before Fehling in suggesting the use of an alkaline copper solution containing tartrate in sugar analysis. The article on this solution is to be found under "Barreswil's or Fehling's Solution," a heading few will refer to. "Barley" is dealt with in a perfunctory manner; the article is identical with that published in the previous edition. The same may be said of the article on Beet-Root, which should certainly have been extended in view of the importance of the beet in sugar production and the possibility of a home sugar industry being established, although this part of the subject will, presumably, be dealt with under "Sugar." "Brewing" has been cut down from 38 pages to 19; but the present article gives a succinct account of this branch of technology without any wearying details of analytical methods and the interpretation of their results. Your reviewer is constrained to point out a misstatement in the allusion to his work. He is accredited with having shown that malt contains maltase.

Apparently the mistake arises from the fact that he was the first to detect glucose among the products of the protracted action of malt diastase on starch. He has, however, repeatedly pointed out that malt diastase does not hydrolyse maltose.

The few citations made above are sufficient to show that the new edition of the Dictionary has been brought well up to date and considerably enlarged. It cannot fail to continue to enjoy the high reputation which previous editions have earned.

Arthur R. Ling.

Technical Records of Explosives Supply, 1915—1918. No. 1. Recovery of Sulphuric and Nitric Acids from Acids used in the Manufacture of Explosives: Denitration and Absorption. *Pp.* viii.+56. *Ministry of Munitions and Department of Scientific and Industrial Research.* (*London: H.M. Stationery Office.* 1920.) *Price* 12*s.* 6*d. net.*

According to the prefatory note, "this is the first of a special series of Reports which are being published in order to make available, for the benefit of the industries concerned, results of scientific and industrial value contained in the technical records of the Department of Explosives Supply of the Ministry of Munitions. The work recorded in these reports was done at, or in connexion with, some of the National Factories during the war. The preparation of the necessary abstracts of information was begun by the Ministry of Munitions at the close of the war, and arrangements have recently been made by the Department of Scientific and Industrial Research to complete them. The Department wishes it to be clearly understood that the interesting information contained in this series of reports is the result of the labours of the Ministry of Munitions, and is being compiled by Mr. W. Macnab, an officer of that Ministry now attached to the Department."

It may be said at once that the Ministry and Mr. Macnab are to be congratulated on the result of their labours. It must have been no inconsiderable task to reduce the mass of data with which they had to deal to the dimensions of the present volume, and present the result in an eminently lucid and readable form.

The book is divided into two sections, the first of which, occupying 25 pages, deals briefly with the composition and probable constitution of the spent acids to be denitrated, with the reactions taking place during denitration, and with the recovery and absorption of the nitric acid and oxides of nitrogen leaving the denitrators. The conditions for the most efficient working of the denitration and absorption processes are very fully discussed, and illustrated by data taken from actual large-scale practice. In reading the introductory pages one is again struck with what must have impressed most technical chemists during the war-period, namely, the lack of published data, or the inaccuracy of existing data, regarding the properties of many of the commonest substances. The uncertainty of the nature of the reactions of nitrosyl sulphuric acid and its stability, which had to be re-investigated, are cases in point. The rate of oxidation of nitric oxide and the influence of temperature on it were also uncertain and required revision, although this point has now been settled by the accurate investigation of Bodenstein. There is an ample field of useful investigation for the young research-worker in the determination or redetermination of the physical constants of many common inorganic substances. How often, *e.g.*, were the data for the solubilities of such substances and the densities of their solutions found wanting.

The second section of the book deals with plant design and operation, and gives an excellent account of the more or less standardised practice in the Government factories. The storage, delivery and denitration of the spent acids, and the construction and cost of the denitrating columns are discussed in detail. This is followed by a description of the coolers for the denitrated sulphuric acid, the Hart condensers for the nitric acid in the gases leaving the denitrators, and a detailed discussion of the construction, packing and circulation of acid in the absorption towers. Particularly interesting is the description of the various types of air-lift, which did such yeoman service in the elevation of the acid to the towers.

The last five pages contain a description of some of the departures from standard practice in denitration and absorption. Of these the most important are the attempts to subsitute larger columns or towers of brick laid with acid-proof cement for the usual denitration columns and absorption towers. Unfortunately the development along these lines was stopped by the closing down of the plant. One must regret that the solution of this important technical problem was not effected. With the plant erected and the experienced chemists to work it, the cost would have been relatively trifling. But these matters are not in the hands of the chemist.

A notable feature of the book is the large number of excellent scale drawings of plant and plant details; the whole treatment of the subject is preeminently practical.

If the high standard set by the present volume is maintained by the subsequent reports of the series, the Ministry of Munitions and the Department of Scientific and Industrial Research will have cause for congratulation.

Joseph Knox.

Probleme und Aufgaben der Nahrungsmittelchemie. *By* Dr. E. Eichwald. *Pp.* 99. (*Dresden and Leipsig: Th. Steinkopff.* 1921.) *Price, paper,* 4*s.* 5*d. net.*

The chemical worker with any leaning towards biology—and an increasing number of us are, fortunately, so attracted—has always found great interest in the investigation of the chemistry of the sugars, fats and proteins which are the main constituents of our foods. The discoveries, first of the importance in nutrition of each individual amino-acid, and, later, of the accessory food substances—better known, unfortunately for our nomenclature, as vitamins—have stimulated active inquiry into minor differences in structure and the influence of physical-chemical factors, with the result that the science of nutrition is advancing very rapidly to a position which before long is bound to reflect favourably on the public health. The chemistry of these substances has passed from the apparent simplicity with which it is detailed in the text-books to a state of considerable complexity, and probably many of us are unaware of the problems which are attracting the interest of the active workers in the field. Dr. Eichwald—who is himself abandoning the academic for an industrial career—has done considerable service in stating in a commendably brief form some of these problems, dealing more especially with those presented by the proteins, and the fats, as well as with physical problems such as the hydrogen-ion concentration, and particularly those associated with the colloid state. A final section is devoted to the synthetic preparation of food substances. The book is both stimulating and helpful, and being free from burdensome detail is easily readable.

It is perhaps of moment to detail some of the problems connected with the fats, as this branch of chemistry has received least attention for some years past, and badly needs renewed interest on the part of our research workers. The fats differ from the proteins in being optically inactive, and as a consequence biological methods, for example, the use of enzymes and fermentation tests, are not available for their study. Inasmuch, however, as we can distinguish between the α- and β-positions of the hydroxyl in the glycerol molecule, there are five possible isomerides of a diglyceride with two different fatty radicles, and a considerable variety of isomeric triglycerides. It is the presence of such mixed glycerides that gives to any natural fat its particular properties, and the characterisation of all fats on such lines requires taking in hand. For example, lard contains an α-palmito-distearin, mutton tallow a β-palmito-distearin and tristearin which is absent from lard. The butyric acid in butter is present not as tributyrin, but in the form of a mixed glyceride, viz., butyro-palmito-stearin. The synthesis of such mixed glycerides is a difficult matter, though it has been facilitated by the work which was being carried out under the control of Emil Fischer at the time of his death. The study of the fats by physical-chemical methods gives some clue to their constitution. Thus the rate of hydrolysis of α and β butyro-stearins will not be the same, though the saponification equivalent is the same in each case. Another possible characteristic may be the difference between the melting-points of the glyceride and the fatty-acid mixture derived from it Again, the rate of absorption of iodine by an unsaturated glyceride will depend on the position of the unsaturated acid. E. F. Armstrong.

The Extra Pharmacopœia. Vol. II. *By* W. Harrison Martindale *and* W. Wynn Westcott. *Seventeenth edition. Pp. xxii+688. (London: H. K. Lewis and Co., Ltd.* 1921.) *Price 17s 6d. net.*

This volume has been considerably enlarged and re-arranged, and reflects the continued advances in scientific medical treatment which are referred to under the various headings, Organotherapy, Iontophoresis, Radiology, Radium Treatment, etc. Many useful notes are included in the analytical addenda to Materia Medica, which forms a supplement to the first volume of the work. References to such subjects as nitrogen fixation, vitamins, standardisation of bread and flour, etc. indicate the varied scope of the book. The analytical tables compiled by the authors are of great assistance to the chemist. These comprise a table showing the action of acids on the common metals and their oxides, indicators used in volumetric analyses, and an organic-analysis chart for the recognition of 266 organic compounds used in medicine which shows their behaviour towards various reagents with corroborative tests. The records of experimental work conducted by the authors on the hydrolysis of acetosalicylic acid, the estimation of arsenic in organic substances, the chemical assay of digitalis preparations, and the effect of chemicals on the action of pancreatin and papain, are an indication of the practical nature of the work. Notes on the antiseptic power of chemicals and disinfectants, carbolic acid coefficients, and the fumigation of rooms, are of interest to the pharmacist and the medical man. Analytical memoranda include chemical and microscopic methods for the examination of urine, blood, fæces, etc., the examination of stomach contents, and the analysis of water, milk and butter. Under bacteriological notes, details are given for identifying pathological organisms, the preparation of serums and antitoxins, culture media and stains. These notes occupy nearly 100 pages of close print, and give the latest information relating to the various tropical and other diseases due to organisms on which researches are still being carried out. Other sections useful to the practising pharmacist are alcohol dilution tables, a list of stain removers, the composition of mineral waters and proprietary medicines, and a glossary of common terms used in prescriptions in Arabic, Dutch, Danish, French, German, Italian, and Portuguese

The enormous amount of information contained in this small book can only be realised by an intimate study of its contents. It will be found invaluable to the busy medical man and the practising pharmacist who at times is consulted on every conceivable subject connected with chemistry, pharmacy and medicine. "Martindale and Westcott" is a veritable encyclopædia as well as a practical text-book. A complete index for the two volumes is given, the subjects dealt with in Vol. II. being printed in heavy black type. Printer's errors are very few, such as have been noticed being of little importance. The book deserves to be well received to repay the labour which has been entailed in bringing it up-to-date. C. T. Bennett.

PUBLICATIONS RECEIVED.

Analyses and Energy Values of Foods. *By* Dr. R. H. A. Plimmer. *Pp.* 255. *(London: H.M. Stationery Office.* 1921.) *Price* 6*s.*

A French-English Dictionary for Chemists. *By* Austin M. Patterson. *Pp.* 384. *(New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.* 1921.) *Price* 18*s.*

Technology of Cellulose Esters. *By* E. Chauncey Worden. *In* 10 *volumes. Vol. I.,* Parts I. to V. (5 *books*). *Pp.* 3709. *(London: E. and F. N. Spon, Ltd.* 1921). *Price* £10 10*s.*

Animal Proteins. *By* H. G. Bennett. *Industrial Chemistry Series, edited by S. Rideal. Pp.* 287. *(London: Baillière, Tindall and Cox.* 1921.) *Price* 15*s.*

Dictionary of British Scientific Instruments. *Issued by the British Optical Instrument Manufacturers' Association. Pp.* 334. *(London: Constable and Co., Ltd.* 1921.) *Price* 21*s.*

L'Industrie des Matières Colorantes Organiques. Vol. I. Les Produits Intermédiaires. *By* André Wahl. *Second edition. Encyclopédie scientifique, publiée sous la direction du Dr. Toulouse. Pp.* 350. *(Paris: Gaston Doin.* 1921.) *Price, paper,* 10 *fr.; cloth,* 12 *fr.*

Die Schwimmaufbereitung der Erze. *By* Dr. P. Vageler. *Pp.* 98. *(Dresden and Leipzig: Theodor Steinkopff.* 1921.) *Price, paper,* 4*s.* 4*d.*

Kelly's Directory of Merchants, Manufacturers and Shippers of the World. *Thirty-fifth edition, in* 2 *volumes. Vol. I., pp.* 2670; *Vol. II., pp.* 1868. *(London: Kelly's Directories, Ltd.* 1921.) *Price* 64*s.*

Report of the Dominion Grain Research Laboratory, Winnipeg. *Board of Grain Commissioners for Canada. Department of Trade and Commerce. (Ottawa: J. de L. Tache.* 1920.)

Publications of the United States Bureau of Mines. *Department of the Interior. (Washington: Government Printing Office.* 1921.)

Chlorination of Natural Gas. *By* G. W. Jones, V. C. Allison, *and* M. H. Meighan. *Technical Paper* 255. *Price* 10 *cents.*

Publications of the United States Geological Survey. *Department of the Interior. (Washington: Government Printing Office.* 1921.) :—

Talc and Soapstone in 1919. *By* J. S. Diller.

Fuller's Earth in 1919. by J. Middleton.

Silver, Copper, Lead and Zinc in the Central States in 1919. *By* J. P. Dunlop.

Antimony in 1919. *By* F. C. Schrader

THE SECOND INTERNATIONAL CHEMICAL CONFERENCE.

The Second International Conference of Pure and Applied Chemistry was held in Brussels from June 25 to 30 under the presidency of Prof. C. Moureu (France). The meetings were held in the Palais des Académies, with the exception of the initial reception which was held at the Maison des Etudiants. There were numerous social functions, a visit was paid to the sugar-refinery at Tirlemont, and at the end of the meetings a banquet was given by the Belgian National Chemical Council at which Prof. Moureu and Sir William Pope expressed the thanks of the foreign delegates for the generous hospitality accorded them by their Belgian colleagues.

At its preliminary sitting the Council, composed of representatives of the countries already admitted, unanimously approved the admission to the Union of Argentina, Japan, Monaco, Norway, Portugal, Rumania, Switzerland, Uruguay, and Yugoslavia. The General Assembly which followed approved the action of the Council and passed the financial report for the past year. Thereupon the Conference, including the new members, proceeded to discuss, in Council or in General Assembly, the items on the agenda, which were mainly in the form of reports of committees appointed last year at the Conference in Rome (*cf.* J., 1920, 251 R). Eighty-two delegates from 18 countries were present, France sending 26, Belgium 15, Italy 12, Netherlands 4, and Switzerland 4. Great Britain was represented by Sir William Pope, Dr. S. Miall, and Prof. T. M. Lowry, and the United States by Dr. F. G. Cottrell, Prof. C. Mackall, and Prof. J. B. Conant.

Atomic weights, etc.—It was resolved to reorganise the existing International Committee on Atomic Weights under the title of the International Committee on Chemical Elements (*Commission Internationale des Eléments Chimiques*), and that it should be consisted of twelve members and divided into three sub-committees to deal respectively with atomic weights, the compilation of a table of isotopes, and the constants of radioactive elements. The functions of the Committee as a whole are to stimulate research, assist investigators, and to draw up annual reports on the progress achieved in each of the three subjects mentioned.

Nomenclature.—The report of the Committee on Nomenclature was adopted unanimously; it recommends:—(a) The formation of three international committees on nomenclature, one for organic chemistry, one for inorganic chemistry, and the third for biological chemistry. (b) The formation of three working sub-committees, of six members each, elected by the international committees, each member being entrusted with the task of forming, with the aid of his national federation, a national committee to discuss questions of nomenclature; the proposals put forward by a national committee to be embodied in a report for circulation among chemists of other nationalities. Nations unrepresented on the sub-committees to transmit their proposals to all the members of the sub-committees. Members of the sub-committees to meet yearly to discuss and submit definitive recommendations to the international committees.

Bibliographical contractions.—It was decided to recommend that, subject to agreement with the American Chemical Society, the Bureau of the Union shall ascertain from the federal or national councils if the principal chemical journals would adopt the system of abbreviations recommended, provided that there was a sufficient majority in favour of it. The result of this inquiry will be communicated to the Conference of 1922, which will then make definitive decisions; but it is obvious that success will only be attained if a large majority of the journals concerned agrees to adopt the recommendations. The generous offer of the Argentine Chemical Society to defray the expenses of the inquiry was accepted with thanks.

Chemical abstracts.—The following recommendations relating to the unification of abstracts, put forward by the National Council of the Netherlands, were accepted:—(1) That the Bureau of the International Union take the initiative in bringing together representatives of chemical journals that publish abstracts with a view to discussing the eventual formation of a central publication and its probable cost. (2) That the possibility of conducting an international chemical card-index be investigated together with the approximate costs of establishing and maintaining it.

International Institute of Chemical Standards (*cf.* J., 1921, 164 R).—On the report of M. Timmermans it was agreed that in order to obviate confusion the three sections of the above Institute should be named as follows:—(a) Bureau of Physico-chemical Standards (with headquarters at Brussels). (b) Research Chemicals (headquarters in England). (c) Department of Publications concerning Industrial and Technical Products (headquarters in Paris). Further recommendations accepted were:—(1) The national council or federation of each affiliated country be invited to nominate a correspondent to act as intermediary on all questions coming within its jurisdiction. (2) In order to promote the more speedy realisation of the plans of the Bureau of Physico-chemical Standards, the Conference asks the Council of the Union to provide this Bureau with a subsidy of 10,000 francs, renewable yearly.

Thermochemical standards.—The General Assembly also sanctioned the recommendations presented by the Committee on Thermochemical Standards, viz., that authors of researches in thermochemistry should specify the substance they have used for standardising the calorimeter employed; and that methods of determining the heat of combustion of the substance chosen as standard should form the subject of an independent report.

The report of the Committee on Tables of Constants, submitted by M. Ch. Marie, was adopted.

Four special matters relating to applied chemistry were then considered:—

Analyses of foodstuffs.—It was announced that through the efforts of the National Federation of Chemical Societies in France, the French Parliament had passed a Bill approving the convention of October 16, 1912, by which the results of analyses of substances intended for human or animal consumption should be stated in a uniform manner, and also a convention of the same date creating a permanent international bureau of analytical chemistry to deal with these matters. The Conference asked the Bureau of the Union to make known these intimations to all the affiliated organisations in order that they may take steps to obtain similar ratification from the Governments of their respective countries.

Ceramic products and fuels.—On the report of M. Amé Pictet, the principle of establishing national and international laboratories for the study of ceramic products and fuels was approved. The proposal to establish laboratories for the investigation of refractories was also agreed to, but in order to save expense it was decided that such laboratories should be attached, as special sections, to the fuel laboratories.

International patents.—No recommendations were forthcoming from the Committee on International Patents, but the Committee was re-appointed for another year. The Assembly, however, passed unanimously a resolution to the effect that the institution of international patents is highly desirable, and that the Union should take the initiative by calling a conference to consider the question.

Industrial hygiene.—The committee charged with the study of health problems in relation to chemical industry recommended as follows:—That students of medicine, chemistry, and engineering should receive such instruction in industrial hygiene as will enable them to form a just estimate of its significance. The dissemination of information relating to actual and prospective progress in industrial hygiene would be of great service in popularising knowledge concerning means of protection from industrial diseases not only to workpeople, but to those who live near factories. To realise this end as rapidly and as economically as possible, the co-operation should be invited of the *Revue Internationale d'Hygiène Publique*, which was founded at Geneva in 1920 by the Red Cross League.

Before breaking up, the Conference resolved that the next meeting of the Union should be held in France.

ASSOCIATION OF BRITISH CHEMICAL MANUFACTURERS.

The past year, the fifth in the history of the Association, has been one of considerable activity, and in spite of somewhat difficult conditions progress has been very satisfactory. There has been a small net increase in the membership, and at the close of the year ended May 31 last the number of members was 151, representing a capital of approximately £100,000,000. Relations with affiliated Associations continue to be completely harmonious.

The position of the British dyestuffs industry has been considerably modified by the passing of the Dyestuffs (Import Regulation) Act, which came into force on January 15, 1921. Incidentally the introduction and passing of the Bill resulted in bringing the makers of dyestuffs in this country into closer co-operation, and those who were not already members have joined or re-joined the Association. In the negotiations which preceded the introduction of the Bill and its passage through the House, the Association was able to play a useful part. Although the opposition both inside and outside of Parliament was skilfully organised, the Bill was ultimately passed with practically no alteration to the original draft. The Association has three representatives on the Advisory Licensing Committee, and the appointment of the newly-formed Development Committee, with Mr. W. J. U. Woolcock as chairman, is an acceptance of the oft-expressed views of the Association. Assistance was rendered by the Association in the preparation of a comprehensive list of dye intermediates required in the administration of the Act; this list has been officially issued by the Board of Trade.

A pamphlet on fine chemicals for research was issued during the year and over 4000 copies were distributed among research chemists and others interested in all parts of the world. This publication has done a great deal in making known to chemists the research chemicals which are manufactured in this country and in securing co-operation among scientific and industrial chemists. It is hoped that a new edition will shortly be published containing a longer list than that in the first preliminary issue.

The schedule proposed to be submitted to chemical manufacturers in regard to the Census of Production was referred to the Association for criticisms and suggestions by the Board of Trade, and as a result of conferences and a deputation to the Board of Trade, the schedule was considerably modified and amplified to the advantage of the industry and the community at large. The unfortunate industrial conditions have, however, caused the postponement of the Census until 1923.

The activities of the Association in connexion with chemical plant and the formation and objects of the new British Chemical Plant Manufacturers' Association have already been described in these columns (*cf.* J., 1920, 407 R; 1921, 143 R). During the year the Chemical Engineering Committee presented a report on the training of chemical engineers, and its conclusions were confirmed by the replies received to a *questionnaire* circulated among the members of the Association. A final report is now being prepared and when it is completed the Council will consider the advisability of collecting information regarding the courses of training in operation in other countries.

The draft Regulations of the Home Office relating to dangerous and unhealthy industries (*cf.* J., 1921, 39 R) received the earnest consideration of the Association and as a result of representations made by it the authorities have agreed to re-draft certain of the regulations and to confer with the Association on any suggested further changes.

The subject of railway transport has also been very prominently before the Association during the past year and evidence was given on its behalf before the Rates Advisory Committee appointed under the Ministry of Transport Act, 1919. The Committee's recommendation that the power of deciding what merchandise should properly fall within the term "Dangerous Goods" should be decided by a tribunal, and not by the railway companies, should prove of great value to chemical industry and help to remove some of the onerous conditions now imposed on merchandise which cannot rightly be termed dangerous. Another important recommendation is that Dangerous Goods should be classified in the same way as other merchandise and that the rates imposed should be disintegrated so as to show separately the amounts charged for each particular service. The effect of this will be that chemical manufacturers will only pay rates for the services actually performed by the railway companies, and not a composite rate, as at present, which cannot be analysed (*cf.* J., 1921, 7 R). A co-ordinating committee representative of the large trade associations has been formed, of which Mr. Malacrida, the Association's transport manager, is a member, and this body is at present negotiating with the railway companies on matters affecting classification. The Association's views on the undesirability of extending the powers of the railway companies in regard to road-traffic have been laid before the committee appointed by the Minister of Transport to consider this question; a majority of this committee is opposed to the extension of the facilities granted to the railways for the collection or delivery of rail-borne merchandise.

The Dominions Touring Exhibition organised by the Department of Overseas Trade was, at the request of this Department, brought prominently to the notice of the members of the Association and over twenty members undertook to participate in a co-operative exhibit under the auspices of the Association. It is to be regretted, however, that similar support was not forthcoming from other industries and that the scheme has had to be postponed for this reason.

The Council has secured representation on the Chemical Warfare Committee appointed by the War Office, and its views on atmospheric pollution by smoke and noxious vapours have been presented before a Departmental Committee charged with the consideration of the present state of the law on this question.

The official directory of members of the Association with a classified list of their manufactures, in seven languages, continues in strong demand and the Council has made preparations for a new edition to be issued next year.

The fifth annual meeting of the Association was held at Burlington House, W., on July 14. Sir John Brunner, who presided, said that as a piece of protective legislation, the Dyestuffs Act was as fair an Act as could be devised, because the Committee which settles questions arising out of it was composed of both manufacturers and users; difficulties were gradually being solved and the scheme would be successful. The work of the Association in regard to railroad transport was sufficient in itself to justify the existence of the Association. The advice given by their representative, Mr. Max Muspratt, to the Departmental Committee on Smoke and Noxious Vapours, viz., that the Committee should work on the lines of the Alkali Act, was very sound, and if followed, chemical manufacturers would have nothing to fear; it was their duty to do all they could to purify the atmosphere of our big towns. The Association ought to raise the strongest protest against the procedure of the Home Office in regard to the Regulations under the Factory and Workshops Act. As was well known, Parliamentary business at the present time was so congested that Departments were left to make regulations which had the force of law. The Home Office actually had the power, without appeal, to prohibit any chemical process. During the past year the Association has encouraged research in many ways and had made a substantial donation to the Chemical Society's Library. The work of the Joint Research Committee of the Association and of the British Chemical Plant Manufacturers' Association would, he believed, result in securing the standardisation of plant of many types and materially cheapen its cost to manufacturers. In various ways the Association had been striving to bring about co-operation among manufacturers, and its efforts in this and in other respects were a source of congratulation.

Dr. E. F. Armstrong, alluding to recent and prospective legislation, said that it was very important that manufacturers should not relax their efforts to make themselves independent of the Government, whose assistance would be too dearly bought if it involved too much interference. They must also see to it that delay, so dear to the heart of the bureaucrats but the greatest enemy of trade, did not result from this new legislation. Dealing with the subject of chemical plant, he said that in the old days the chemical manufacturer in this country had either to get it made from his own design at a local foundry, and often find that it would not work, or put himself in the hands of the Germans and take what they chose to sell him, generally, he admitted, with satisfactory results; or he had to go to some of the few manufacturers of chemical plant in this country, pay rather dearly for his purchase, and as a rule find his requirements only partially met. The action taken by the Association was a valuable first step in the right direction; it was only by pooling knowledge that progress could be made.

Sir William Pearce, treasurer, after congratulating the Association on its financial position, asked the opinion of the meeting as to the desirability of the Railways Bill, now before the House, becoming law immediately or if it, or any part of it, could be postponed without disadvantage.

The General Manager, Mr. W. J. U. Woolcock, said there had been rather a serious disagreement on the question of exceptional rates. He had come to the conclusion that the railway companies had an almost unanswerable case because it was physically impossible, in the time allowed, to adjust the enormous number of exceptional rates.

The Rt. Hon. J. W. Wilson explained that the Railways Bill consisted of three parts: (1) the question between the Government and the railways as to the sum to be paid to the latter in respect of war claims; (2) the provision of means for settling wages and salaries on the railways; (3) the question of railway rates. He thought that from the point of view of the general welfare it was advisable, and also much easier, in a measure of this kind, which affected three great and distinct interests—traders, railway shareholders, and workers—to arrive at a fair settlement by considering them concurrently.

After further discussion the meeting passed unanimously a resolution urging the Government to proceed with the whole Bill and take every possible step to secure its enactment.

Dr. P. C. C. Isherwood said that it was a matter for regret that fine chemicals had not been included within the scope of the Dyestuffs Bill. The last thing that manufacturers of fine chemicals wanted was to adopt a check on manufacturing output. They wanted to give the freest opportunity to home users to import freely anything which they could not obtain, or had no prospect of obtaining, in this country.

Mr. Max Muspratt expressed the opinion that ultimately the only protection was sound manufacture, which could be promoted by following up their ideas of co-operation. The Dyestuffs Act would be more or less futile if they did not believe that it would lead to much more co-operation and delimitation. In the much more intricate problems of the fine-chemical industry, they would have to make a careful survey and find out what was best to be done.

The Rt. Hon. J. W. Wilson, M.P., has been appointed honorary president in succession to Lord Moulton, Mr. R. G. Perry remains the honorary vice-president, Sir John Brunner continues in office for a second year as chairman, and Mr. Max Muspratt succeeds Dr. E. F. Armstrong as vice-chairman. Sir William Pearce, M.P., continues as hon. treasurer.

POSITION AND PROSPECTS OF THE PLANTATION RUBBER INDUSTRY.

HENRY P. STEVENS.

As everyone interested in the commodity is aware, there is at the present time an over-production, or, as some prefer to put it, an under-consumption of raw rubber. Following a post-war boom, a fall in price of most commodities was not unnatural having regard to the inflated prices reached during and subsequent to the war, but rubber was in a different category, for it was perhaps the only raw material which fell in price during the war, and at the moment of writing is selling at well under the average cost of production.

A decade ago the plantations produced about 14,000 tons out of a total output of 85,000. Last year the plantations produced 315,000 tons of a total output of 360,000, and this in spite of some curtailment of output towards the end of the year. The potential output of the plantation industry for next year is put at 400,000 tons. Two deductions of outstanding importance may be drawn from these figures. First, the proportion of plantation rubber has risen from under 20 per cent. to nearly 90 per cent. of the world's output, and from a relatively insignificant position has now become the dominant factor in the world's supply; and secondly, owing to the large increase in output of plantation rubber, and in spite of a decrease in the production of other sorts, the total output of raw rubber has increased over fourfold in ten years. Such an increase in the output of a raw material in so short a time might well result in over-production, which, indeed, would have been generally anticipated had it not been for the simultaneous increase in the demand due to the growth of the motor industry. In 1917 the output of plantation rubber was already triple that of 1911, and the price varied from 2s. 2d. to 3s. 4d. per lb., thus leaving a good margin of profit over a producing cost of 1s. or 1s. 3d. The present accumulation of stocks (about 60,000 tons in London alone and possibly 300,000 in all) and consequent low market-price may be largely attributed to the general trade depression, particularly in the motor industries. The motor trade has become the paramount consumer of raw rubber, and consequently the future price and position of plantation rubber will be largely controlled by the prosperity of this industry.

As is well known, tyres are of two types, the solid band-tyre with about 40 or 45 per cent. of raw rubber, and the pneumatic tyre with its inner-tube and outer-cover. The inner-tube contains a relatively large proportion of raw rubber, and the same applies to the outer-cover, with the possible exception of the tread. The carcase is built up mainly of layers of canvas, which in some respects is of more importance than the rubber. The tendency is to replace the solid band-tyre by the pneumatic, and giant pneumatic tyres are being experimented with. The writer recently inspected a 3-ton lorry with twin pneumatic tyres, which he was told had been giving very satisfactory service. How far the replacement of the solid by the pneumatic tyre will affect the consumption of raw rubber cannot at present be decided; so much depends on the life of the tyre. Another recent improvement is the introduction of the new type of cord-tyre. The material is woven with stout cords in one direction, and with only thin loose threads to hold them in place in the other direction. This allows the cords to move easily transversely while remaining taut lengthways, and prevents the chafing between the layers of canvas of which the ordinary carcase is built. It is claimed that these new tyres will give a mileage of anything from ten to twenty thousand per tyre, as against, say, six thousand for the ordinary canvas-fabric type. If these claims are only partly realised, the effect on the raw-rubber consumption must be appreciable, particularly if the new type of cord-tyre should be found suitable for replacing the ordinary "solid" for heavy vehicles.

The phenomenal development of the rubber-manufacturing industry during the last twenty years encourages the hope that it may expand sufficiently to absorb any future increase in output of which the plantations may be capable. This may be accompanied not only by the extension of the present uses of rubber but also by the discovery of new uses. The Rubber Growers' Association has offered prizes to encourage inventors to find new outlets. The hindrance to expansion in many directions is the cost of manufacturing, particularly the large amount of expensive machinery required for vulcanising. Relatively few goods can be open-cured or merely wrapped in cloth. As a rule expensive moulds or steam-presses are required, which with the labour brings up the cost of production to a figure out of all proportion to the cost of the raw material. We have become accustomed to regard vulcanising as unavoidable if the goods are to possess the necessary physical and mechanical properties, and no alternative seemed possible. On the other hand, a rubber planter has been bold enough to query the necessity of vulcanisation, at any rate for some purposes, and has found that a sheet of well-rolled raw crêpe rubber makes an excellent sole for a tennis shoe. It is stated that a piece so worn for two or three years showed no appreciable wear or deterioration. There is no doubt that raw rubber is a more permanent and less oxidisable material than vulcanised rubber, so that if rubber can be used unvulcanised it should last longer. For the same reason there is no truth in a report which gained currency a few weeks ago that raw rubber deteriorates on keeping, and consequently that much of the present stocks will be useless when they are taken from storage. Raw rubber ages remarkably well. The drawback to its use without vulcanising lies in its susceptibility to moderate changes of temperature. The strength and other physical properties of raw rubber are improved by vulcanisation, if only temporarily, but plantation rubber is strong enough in the unvulcanised condition for a great many purposes. It must not be forgotten that the value of vulcanisation came to be realised at a time when most raw rubbers came to market as dirty, sticky, and malodorous masses, which even after washing gave soft, weak, and often sticky sheets. The effect of vulcanising these low grades was remarkable; the softness and stickiness disappeared, and marketable goods resulted. Low-grade inferior rubbers have now been driven from the market by the hard, clean, and dry plantation product. The effect of vulcanisation on this is much less apparent; indeed, the very excellence of the rubber is a drawback, for the manufacturers complain of its hardness and "nerve," and the heavy expenditure of power necessary to reduce it to the required plastic condition for incorporating other ingredients and subsequent sheeting and moulding to the shape of the article required. New methods of vulcanising may also lead to new products. Until recently all ingredients had to be carefully dried to prevent porosity. Moisture, however, does not affect the Peachey process of vulcanising; consequently a variety of ingredients containing natural moisture, in particular cellulose in its natural forms, can be incorporated. Products can thus be made which are barely possible and certainly not practicable by the ordinary methods. The same applies to the new method of Bruni, in which thiocarbanilides are formed in a nascent state in the presence of zinc oxide, rubber, and sulphur by compounding aniline or its homologues with those ingredients and exposing to the vapour of carbon bisulphide (*cf.* J., 1921, 237 R).

The present low price of raw rubber has naturally led to a restriction in output. Last year a 25 per cent. reduction was agreed upon both by British and Dutch producers on the initiative of the Rubber Growers' Association. This has not produced much effect, and the proposal is now for a 50 per cent. reduction. The latter suggestion has been adopted by some estates, and two or three have ceased tapping altogether. An estate obviously cannot be shut down entirely and left to itself. The labour force must be kept together as far as possible and work found for the coolies, for if they should be forced to return to their native Indian shores in a disgruntled state it may prove difficult to induce them to come forward later when conditions improve again. Moreover, there is a certain amount of necessary work on a plantation, such as weeding, keeping the drains clear, and plant sanitation. It is useless for an estate to continue tapping if the produce is to be sold at a loss for any length of time, so that the tendency everywhere is to curtail tapping to a degree consistent with keeping the coolie force together as far as practicable. Cessation of tapping also benefits the trees. Present-day methods of tapping are mild compared with those of the past. It is now recognised that drastic tapping injures the tree, and that years may be required for its recovery. The tendency to-day is therefore all in favour of bark conservation. It is not merely the loss of the bark cortex and latex constituents, but the irritation set up appears to be responsible for the most prevalent of diseases known as brown bast. The frequent draining of the latex tubes causes the formation of a wound gum which blocks the vessels, and the trees run dry. This gives rise to various secondary changes, of which the most noticeable is the development of warty growths in the cortex that render the bark surface useless, however vigorous the growth of the tree. In some fields three-fourths of the trees is affected, and if the " physiological " explanation be correct, there can be no better course than a rest cure if the majority of the trees is to be retained. On the other hand, yields from plantations in the future may be enormously increased by suitable seed selection, as the yield of latex varies considerably with individual trees. It has been stated that three-quarters of the latex of a field may be obtained from a quarter of the trees. Consequently, if a selection could be made of the good yielders by choice of seed, by grafting, or other means, the output of rubber per acre should be increased very considerably. At present, however, planters are not anxiously considering these matters. They would rather welcome some convenient disease, which, while reducing the planted area, could be brought to a standstill when the market had sufficiently recovered. As practical business men they are promoting a rubber-control scheme to be affiliated with a similar scheme organised by the Dutch planting interests, with a view to the efficient control of production and the attainment of a stable price for the commodity.

INDUSTRIAL TRUCKS AND TRACTORS.*

W. P. KENNEDY.

One of the most urgent problems in industrial management to-day is the economical application of labour or man-power to manufacturing operations. The development of machinery for definite processes of manufacturing or fabricating was relatively simple, but the application of machines to such indefinite operations as the transport of material through plant or works has been much more difficult, although from the standpoint of reducing costs it is often more important.

At the present time the machines in use are mostly of the electric type, the application of the internal combustion engine for this purpose having been comparatively limited. Electric machines may be divided into two general classes: load-carrying machines which carry the load on their own structure, and tractors which do not carry the load but haul a train of trailers. Either of these forms may be equipped with auxiliary apparatus such as cranes, elevating platforms and hopper-dumping-bodies for handling loose material, but these are more usually applied to the load-carrying type than the tractors. Tractors may be of the 4- or 3-wheeled type, the latter being especially suitable where crooked passage-ways exist, as is often the case in the older works. One load-carrying machine which is coming into general use on account of its labour-saving value is the electric elevating and depressing platform type of truck. The machine with its platform depressed is run under a separate platform or " skid " on which the load has been previously stacked. The platform is then elevated by the electric gear and the loaded " skid " lifted off the floor and carried to its destination where the machine platform is again depressed and withdrawn, leaving the "skid" resting on the floor.

Most modern machines are driven by a single reduction and worm-gear mechanism, with direct but flexible connexion between the worm and motor and the truck driving wheels, the connexion with the steering and driving shaft being entirely enclosed and provided with continuous lubrication. Nearly all vehicles, whether tractors or load-carriers, are equipped for steering with their four wheels, thereby providing for short turning-radius.

The storage batteries with which these vehicles are equipped are either of the lead-plate or " Edison " nickel-iron type, and are generally assembled in trays for convenience of removal and replacement, so as to allow of practically continuous service, although the usual practice is to provide battery-power sufficient for the day's work and to recharge the cells at night. The batteries are commonly operated in series with a controller-arrangement providing for three speeds forward and three reverse, so that the machine can be run with equal facility in either direction.

The motors used are of the 4-pole series type, wound for suitable voltages and having very high overload capacity for short periods; the service in which the machines are employed being intermittent, the frequent stops prevent overheating of the motors and give the batteries opportunity to recuperate. The ampère-rating of these motors is usually between 60 and 70, and the normal speeds vary between 1600 and 1700 rev. per min., the gear-reduction required being 17 to 1 with driving wheels of 20 in. diameter. The speed is normally four miles per hour loaded, and six without loads.

The appended table gives some particulars of these machines:—

Type of machine.	Load carry-trucks.	3-wheel tractors.	4-wheel tractors.
Battery voltage ..	24	32	48
Kilowatt-hour capacity .	5 to 8	7 to 10	11 to 16
Weight of machine, lb...	2500 to 3000	3000	4000
Starting draw-bar pull, lb.	500	1500	—
Do. 4-wheel drive, lb.	—	—	3000
Do. 2-wheel drive, lb.	—	—	1500
Pull when running under normal load, continuous, lb. ..	250	300	400
Do. intermittent service of 30 minutes' duration, lb. ..	—	600	800
Capacity of machine, carrying, lb.	4000	—	—
Capacity of machine, hauling, tons	4	6–10	10-20

When these machines are applied to rail-service, their tractive effort is decreased by two-thirds, and it must be remembered that to obtain the best and most economical results the work of the machines should be so scheduled and co-ordinated with the general factory operations that they are practically in continuous service.

So many factors have to be taken into account in determining the cost of operation that it is not possible to give exact figures, although, broadly speaking, it may be assumed that the daily cost will range from $2.00 to $4.00 where a fair amount of work is performed, although in some instances it may be as low as $1.00 or as high as $5.00. These figures include interest, depreciation, upkeep and power for charging the battery, but not labour for operating.

Trucks vary in price from $2000 to $3000, and tractors from $2200 to $4200.

To arrive at the total annual cost of operating the machines themselves, without trailers or other auxiliary apparatus, and without taking into consideration insurance, overhead and other general charges, the following factors may be fairly used:—Interest at 6 per cent., depreciation 10 per cent., battery upkeep one-third of the original cost, tyre upkeep one-half of the original cost, mechanical upkeep 5 per cent. of the total value of the machine, and power cost at the prevailing rate per kw.-hr., assuming that the battery will require charging up each day to 150 per cent. of its rated capacity.

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* Abstracted from a paper read before the American Section at New York, on April 22, 1921.

SOCIETY OF CHEMICAL INDUSTRY.

JULY MEETING OF COUNCIL.

At the meeting of Council held on July 15, Sir William Pope presiding, a letter was read from Dr. R. F. Ruttan accepting nomination as President of the Society for the year 1921—22, and expressing his appreciation of the honour which the Council had conferred upon him. A grant of £150 was made to the Committee of the Montreal Section towards the expenses of the Annual Meeting. An invitation was received from the Committee of the Glasgow Section to hold the Annual Meeting of the Society in that city in 1922; the invitation was accepted unanimously. A proposal from the Glasgow Section to admit "Associates" to meetings of that Section at the nominal subscription of 5s. per annum was approved; such "Associates" of the Section will not be entitled to receive the Journal and they will have no voting power at meetings.

The Council decided that a "Messel" Memorial Lecture should be instituted to perpetuate the name of Dr. Rudolph Messel, and that a gold medal with an accompanying honorarium should be presented to the lecturer. It was further agreed that the remainder of the income from the bequest should be allowed to accumulate for the present.

It was reported that a meeting of Sectional officers had been held in Manchester to discuss questions of importance to the Society. A report on one of the questions was being submitted to the Publications Committee for its consideration, and other matters would be brought before the Council at the October meeting.

The President intimated that he had arranged for a question to be asked in Parliament as to whether plant and apparatus lying idle in certain Government Factories could be made available for use in the laboratories of Universities and Technical Colleges (*cf.* J., 1921, 215 R).

Dr. S. Miall was elected the Society's representative on the council of the exhibition to be held in April, 1922, by the Coal Smoke Abatement Society. A vote of sympathy was passed with the relatives of the late Dr. H. R. Le Sueur, joint hon. secretary of the Chemical Society. Twenty-three members were elected.

Particulars concerning the Dinner of the Society to be held in October will be found under "Official Notices" in the issue of the *Journal* for July 15.

ANNUAL MEETING, 1921.

A communication has been received from Mr. F. B. Carpenter, Chairman of the Fertiliser Division of the American Chemical Society, inviting all members of the Society of Chemical Industry who are interested in fertiliser chemistry to attend and participate in the meetings of the Division to be held from September 6 to 14 by communicating papers and taking part in the discussions. Any member of the Society of Chemical Industry who desires to accept this invitation and who is prepared to submit a paper is requested to communicate at once with Mr. Carpenter (c/o Virginia-Carolina Chemical Co., Richmond, Va.), furnishing him at the same time with the title of his paper in order that it may be included in the programme of the meetings.

MEETINGS OF OTHER SOCIETIES.

THE FARADAY SOCIETY.

At a meeting held on June 22, Prof. A. W. Porter presiding, a paper on "High Temperature Phenomena of Tungsten Filaments," from the Research Department of the General Electric Co., London, was presented by Mr. C. J. Smithells. Two types of tungsten wire are in general use for lamp filaments; one is composed of pure tungsten, and the other of tungsten containing up to 1 per cent. of a refractory oxide such as thoria. The crystal growth of such filaments during burning has been investigated. In pure tungsten filaments crystal growth is very rapid, and can be detected after a few seconds' burning, whilst a practically constant crystal size is reached after about 15 minutes' burning at the normal temperature of a lamp filament. The author suggests, however, that although the crystal size remains constant with longer periods of burning, the condition is not stable, and the boundaries are in constant movement. Deformation of the filament occurs during recrystallisation and is more rapid during the preliminary period of rapid growth than later in the life of the filament. The refractory particles in a "thoriated" filament restrain crystal growth, so that, after many hours' burning, the crystal size is quite small. Such filaments deform very little during burning. Traces of phosphorus or sodium in a gas-filled lamp will reduce the thoria in a filament and cause an increase in the grain size. These elements are without effect on pure tungsten filaments. Part II of the paper dealt with the chemical reactions which occur in gas-filled tungsten-filament lamps when traces of the common gases are present in the filling gas, and the types of failure produced in each case were described. The effects produced by oxygen, hydrogen, water vapour, carbon dioxide, carbon monoxide, and hydrocarbons were discussed.

A paper by Mr. E. Kilburn Scott described the work of A. McLean Nicholson on "The Piezo-electric Properties of Rochelle-salt Crystals." Certain crystals, when subjected to pressure at opposite ends, generate a potential difference at those ends which may be of considerable magnitude. This is said to be the case only when the crystals possess skew symmetry with regard to the line of pressure (*cf.* J., 1919, 159 R). Rochelle-salt crystals have been found to show this effect to a remarkable degree, and potentials as high as 500 volts have been obtained. The author demonstrated this property by means of a phonograph record which was made to produce vibrations in an aluminium plate in contact with a crystal; the current generated in telephone-receivers attached to the ends of the crystal reproduced the tune on the record. The work promises to be especially valuable in developing a hearing apparatus for very deaf people, and is also being applied to ordinary telephones.

Mr. Emil Hatschek described a simple apparatus for determining the coagulation velocity of gold sols. A transparent rectangular cell is divided into two wedge-shaped halves by a transparent diagonal partition. One half is filled with the red sol to be examined, and the other with the completely coagulated blue sol. A similar cell is filled with the sol and electrolyte under examination. The amount of coagulation at any moment is obtained by colour-matching, the percentage being read directly on a scale.

Prof. Porter described some preliminary investigations into the "Variation of Surface Tension with Temperature"; papers by Mr. A. McKeown on "The Potential of the Iodine Electrode," and by Mr. S. M. Neale on "The Influence of the Solvent upon Ionisation and the accompanying Heat-Effect," were taken as read.

ROYAL SOCIETY OF ARTS.

"Paints, Painting, and Painters, with special reference to Technical Problems, Public Interests, and Health," was the subject of a paper by Prof. H. E. Armstrong and Mr. C. A. Klein read by the former at a special meeting held on July 14.

Recent work by the authors has confirmed the views which they communicated in a previous paper (*cf.* J., 1913, 320), viz., that the so-called lead-poisoning from which painters sometimes suffer is not due to the inhalation of a volatile lead compound but to that of the vapour of turpentine and other volatile liquids used in thinning paint, and of lead-dust produced in rubbing-down painted surfaces. As paint splashes readily dry and might give rise to dust, a painter was put to paint a room clad completely in an overall made of the best-quality filter paper, the splashes which fell upon it were developed by exposure to the vapour of osmic acid, and the number and size of the splashes were measured. In this way it was found that in the operation of stippling a painter is exposed to a shower of falling splashes, against which he should protect himself by wearing an "over-overall" of newspaper on the shoulders and arms. *Per contra*, the splashing produced in the painting of vertical surfaces is almost negligible. It was further ascertained that no paint splash or spray was inhaled by the painter; that in painting vertical surfaces the path of the splashes was vertical; that in stippling vertical surfaces the splashes did not travel beyond 6 inches into the room; and that the paint splashes were never smaller than 30 microns. In the authors' view, the dangers of the painter's work have been exaggerated—his occupation is not unhealthy.

GOVERNMENT ORDERS AND NOTICES.

New Orders.—The Safety Lamps Order, June 18, 1921. Explosives in Coalmines Order, July 15. 1921.

Mining Dangers Research Board.—The Secretary for Mines has appointed Mr. W. Walker (chairman), Mr. T. H. Mottram, Sir R. A. S. Redmayne, the Right Hon. T. Richards, and Prof. R. V. Wheeler, to be a committee to direct research into the causes and prevention of mining dangers.

Manufacture of White Lead, Etc.—The Home Secretary has decided to make certain amendments in the draft Regulations relating to the manufacture of white compounds of lead which were issued on October 22, 1920. The principal alterations include:—(*a*) A more precise definition of the compounds covered by the Regulations. (*b*) Provision and use of respirators in certain processes; weekly instead of fortnightly medical examination. (*c*) Regulation 14 prescribing the provision of breathing-apparatus in condensing chambers has been deleted.

The Metric System in Japan.—A translation of the recent law, whose object is the ultimate substitution of the metric system of weights and measures for the present Japanese system, may be seen at the Department of Overseas Trade, 35, Old Queen Street, S.W. 1.

CORRESPONDENCE.

INDIAN TAN-STUFFS.

Sir,—My attention has been called to a review in your issue of April 15, 1921, of a report by me on the subject of "Indian Tanstuffs." I thank you for your fair criticism, but venture to offer you one or two words of explanation.

The question of prices of tanstuffs has deliberately been left out of my more recent reports, as the question of costs must form the subject of supplementary papers by Forest Officers specially employed in Utilisation Circles on industrial surveys, who have the best facilities for ascertaining the quantity of material available, cost of extraction from the jungle, conveyance of raw material to a central extract factory, etc.

The surmise is correctly made in your review, that the figures of analysis of certain oak and chestnut barks in Northern Burma were the results of my work. My full report on Burma oaks and chestnuts has not yet been published, and determinations of the cost of jungle extraction, manufacture, freight, etc. are now being gone into. So far, nothing has been examined at a greater distance than 5 miles from the railway, but certain districts might have to be tapped which depend on road-motor-transport for their communication with the outside world. It may be stated, meantime, that from the tannin standpoint certain of the oaks and chestnuts of Burma seem to offer better results than anything of the kind hitherto investigated. As, however, the wood is the priucipal source of the tannin in these species, the destruction of the trees is a necessary corollary, and it is only in the case of the following substances that such destruction is to be avoided:—(1) Certain barks which re-grow provided the cambium layer is left intact; (2) the barks of very abundant species which can be removed, spirally in places; (3) twig barks of shrubs, coppice shoots, etc.; (4) fruits; (5) leaves; (6) galls, etc. Since, however, it has always been admitted that oaks and chestnuts yield sole-leathers superior to all others, the destruction of the tree in order to yield the necessary extract has always in such a case been considered "practical politics." In such instances, the Forest Department of a country is careful to replant in rotation as the trees are felled. Unfortunately, chestnuts—and especially oaks—require a long rotation-period; but the high quality of the tannage to some extent compensates for this.

I am surprised by your criticism on the subject of "Crystals." In my experience, even years ago when I was employed as a tannin-chemist in England, crystal extracts were becoming increasingly popular owing to the relatively greater ease with which they can be brought into solution. Were I to take solid block extract as the standard,* that would only tend to enhance the apparent value of the species in respect of yield, whilst diminishing it as regards the maximum possible tannin-content of the extract. In any case, it is easy to calculate from "crystals" with 5 per cent. moisture the corresponding figures for solid block extract at. let us say, 15 per cent. moisture—a conservative figure when calculating yield.—I am, Sir, etc.

J. A. Pilgrim.

Dehra Dun, India.
May 25, 1921.

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* In most of my recent reports, e.g., "Sundarbans" and North Bengal (Buxa), I have takeu both solid extract *and* "crystals."

NEWS AND NOTES.

BRITISH INDIA.

The Acetone Factory at Nasik.—During the war the erection was started of an acetone factory at Nasik to make acetone and butyl alcohol by the fermentation of starch according to the Weizmann process. The cost, which was borne by the British Government, was considerable, as the buildings are of solid masonry, and the provision of quarters for the staff and workers are on a very generous scale. Consequently it has not proved a financial success, and it has recently been decided to hand over the factory to the Bombay Government, presumably in order to experiment on the production of power alcohol. (*Cf.* J., 1921, 30 R.)

Crop Forecasts of Winter Oilseeds.—The following forecasts are based upon reports from provinces which contain 98·6 per cent. of the total area under rape and mustard and 99 per cent. of the total linseed area in British India. The season was not favourable, and the condition of the crops was, on the whole, only fair. The total area under rape and mustard is reported to be 4,912,000 acres, which is 17 per cent. below the average of last year, and the total estimated yield is 848,000 t., as against 1,153,000 t. a year ago, or a decrease of 26 per cent. Linseed is grown over 2,234,000 acres, a decrease of 28 per cent., and the estimated yield for 1920—21 is 269,000 t., a decrease of 36 per cent. below that of last year (419,000 t.).—(*Ind. Tr. J., June* 19, 1921.)

CANADA.

Cascara in British Columbia.—According to the *Canadian Forestry Journal*, most of the world's supply of cascara bark was obtained before 1914 from Japan, Germany, and the United States, but during the war the German supply was cut off and careless exploitation of the bushes in Washington and Oregon soon eliminated the United States as a competitor. Botanists and Government forestry officials had long known of the existence of the plant in British Columbia where the conditions for growth are most favourable, but until recently no efforts were made to utilise it commercially. Now, however, a company is being formed to cultivate cascara for supply to drug manufacturers. Five tons of bark from British Columbian forests have recently been shipped to American drug manufacturers, and the Province is now to be regarded as the largest source of supply.

UNITED STATES.

Industrial Alcohol and Prohibition.—According to a statement issued by the American Chemical Society, the decreased production of industrial alcohol in the United States resulting from too narrow an interpretation of the existing laws is proving a serious handicap, if not a menace, to industry. Alcohol is required in large amounts for both industrial and medicinal purposes, and it is assuming still greater importance as a fuel on account of the growing shortage of petroleum. Thus a single artificial silk company in Virginia uses 10,000 galls. per day as a solvent for nitrocellulose, and millions of gallons are used every year in the manufacture of cinematograph films. In fact the situation has become so serious that manufacturers of celluloid are contemplating the transfer of their factories to Canada, where there are fewer restrictions on the use of alcohol for industrial purposes. Whereas the production of industrial alcohol was 110 million galls. in 1917, the output had declined to 56 million galls. in 1920, and a recent survey showed that 53 per cent. of the industrial-alcohol plants had been closed down or scrapped. In addition, a large part of the production is being exported. The remedy is indicated in the suggestion that the Volstead Prohibition Act should be so altered that the question of industrial alcohol is completely separated from that of prohibition, an entirely different matter, so that adequate supplies for power production and industrial use can be ensured.

Tungsten in 1918.—The tungsten ore produced in the United States in 1918 was equivalent to 5061 short tons of concentrates carrying 60 per cent. WO$_3$, valued at $7,049,300 (1916, 5923 t.; 1917, 6144 t.). The 5061 tons was composed of 1910 t. ferberite, 55 t. huebnerite, 273 t. scheelite, and 362 t. wolframite. Colorado and California were the chief producing states, the former supplying ferberite and the latter scheelite. The cost of production per ton of ore is estimated by experts to be $11.35—12.80. A remarkable development of the year was the large production of scheelite in the Great Basin region from contact-metamorphic deposits—limestones altered by solutions accompanying intrusions of granite.

Importations were equivalent to 12,729 short tons of ore carrying 60 per cent. WO$_3$, and exports were 616 t. of tungsten and ferro-tungsten and the equivalent of 1265 t. of 60 per cent. ore. The apparent consumption was 10,525 t., allowing 6000 t. for stocks on hand at the end of the year.

The world's large tungsten fields, exclusive of the Iberian Peninsula, are grouped along the shores of the Pacific Ocean—not all very close to it, but somewhere in the great mountain masses that run parallel to its margin—and the Asiatic shore is much richer than the American shore. In 1918 nearly 92 per cent. of the world's production came from the Pacific shores, in which are included the deposits in Colorado and South Dakota.

World's Production of Tungsten Ore, 1916—1918.
(*Metric tons of concentrates containing* 60 *per cent.* WO$_3$.)

	1916.	1917. Metric tons.	1918.
Japan	730	763	629
Chosen (Korea)	555	900	1,097
China	109	1,361	10,187
Tonkin	343	433	450
Burma and Shan States	3,464	4,226	4,138
Siam	530	726	185
Malay States, Unfederated	317	334	1,156
Malay States, Federated	524	721	362
Billiton and Singkep	47	8	55
India (excluding Burma)	46	68	44
Australia	1,052	1,277	1,351
New Zealand	315	235	170
Chile	9	2	—
Argentina	854	1,056	613
Bolivia	3,288	4,215	3,703
Peru	532	427	251
Brazil	5	—	—
Mexico	159	308	239
United States	5,330	5,545	4,578
Alaska	43	29	13
Canada	—	—	15
Norway	1	1	—
Sweden	—	—	3
England	407	245	308
France	162	261	212
Portugal	1,418	1,580	1,150
Spain	425	446	579
Italy	5	1	—
Germany	330	300	300
Austria	10	10	10
Russia	33	33	33
South Africa	3	12	34
Totals	21,046	25,523	31,865

No striking changes in the metallurgy of tungsten were recorded during 1918, but there was a steady improvement in the utilisation of low-grade ores, in the quality of the ferro-tungsten made, and considerable changes in the manner of use.—(*U.S. Geol. Surv., Mar.* 21, 1921.)

Mica in 1919.—The mica produced and sold in the United States in 1919 amounted to 4031 short tons ($541,651), including 3258 t. of scrap and 773 t. of sheet mica. Compared with 1918 there was a decrease of 6 per cent. in the output of sheet mica and an increase of 42 per cent. in that of scrap. The mica exported was valued at $109,348, the imports of sheet mica at $1,488,769, India supplying 49 per cent., Canada, 14, Brazil 26, and Argentina 15 per cent. Imports from Argentina and Brazil are increasing rapidly, but those from Canada are steadily decreasing. More than 90 per cent. of the sheet mica consumed in the United States is used for electric insulation. Ground mica is used for decorative purposes, as a lubricant, an insulator, and a filler.—(*U.S. Geol. Surv., Mar.* 28, 1921.)

JAPAN.

The Salt Industry.—The salt monopoly (*cf.* J., 1919, 207 R) was introduced in Japan for revenue purposes towards the close of the Russo-Japanese war. Although fairly successful at first, discontent arose later owing to the slow progress of the industry, increasing costs of production, and consequent high prices. A Commission has been appointed to consider the advisability of retaining the monopoly, and its decision will be carefully weighed in view of the growing danger of a shortage of industrial salt. That there is a strong and growing demand which cannot be met even if the salt-fields were considerably extended is shown by the trade statistics. In recent years exports have remained steady, with a tendency to decrease, but imports have increased from under 30 long tons in 1915 to over 400,000 t. in 1919. According to a leading newspaper, the Commission has found that the total production of salt in Japan and dependencies in 1919 was about 1,053,600 t., imports 413,417 t., exports 12,767 t., and the domestic consumption is said not to exceed 880,000 t. (?) The appended statistics give the production, exports and imports in recent years:—

	Production. Long tons.	Exports. Long tons.	Imports. Long tons.
1905	187,409·6	2,845·3	22,250·5
1910	319,007·2	14,437·2	30,240·7
1913	360,013·3	19,660·9	42,118·9
1914	343,649·0	19,423·6	59,341·6
1915	336,051·6	27 632·0	50 621·7
1916	349,241·8	29,221·9	63,739·0
1917	338,865·4	38,362·8	130,849·8
1918	228,114·4	35,459·5	201,240·2
1919	331,348·4	—	295,965·6

(kin=1·323 lb.)

—(*Bd. of Trade J., June* 9, 1921.)

The Japanese Pharmacopœia.—In the fourth edition of the Japanese Pharmacopœia, which has recently been issued, 682 drugs and chemicals are listed as compared with 703 in the third edition. In many cases foreign drugs are replaced by Japanese substitutes.—(*Chem.-Z., July* 5, 1921.)

GENERAL.

"Manganese, 1913—1919" (pp. 151, price 3s. 6d. net), issued by the Imperial Mineral Resources Bureau, comprises as complete a statistical record of the world's production and consumption of manganese ores as is possible from the available published sources, and also contains much valuable information relating to the ore-minerals, uses and valuation of manganese ores for metallurgical and chemical purposes and their cost of production. Before the war the principal countries producing manganese ore were Russia (highest production 1,234,900 tons in 1913), British India (900,000 tons in 1907), and Brazil whose development had long been retarded by the distance of the mines from the nearest shipping port but whose production reached 524,290 tons in 1917 for export to the United States to replace supplies of ore normally obtained from India or ferro-manganese imported from England. Other sources of ore of growing importance are those of the Gold Coast and the Sinai Peninsula.

Although probably 95 per cent. of the world's production of manganese ore is used in the iron and steel industry, of which it forms an essential factor, considerable quantities are used in the chemical, glass, ceramic, electrical and other industries. The value of manganese ore for use as an oxidiser in non-metallurgical industries depends essentially on its content of available oxygen, and the ore for such purpose is therefore sold on its percentage of manganese peroxide. Before the war high-grade Caucasian pyrolusite was almost exclusively used as the manufacturers of dry cell batteries and the glass manufacturers called for 85 per cent. MnO_2 and under 1 per cent. iron, but latterly peroxide ore containing up to 2 or 3 per cent. of iron has been used for dry cells without loss of efficiency.

Skin Diseases due to Contact with Oils.—It has long been known that on prolonged contact oils of all types may produce lesions of the skin, affections which have been described by various observers under different names. Professors C. G. Page and L. D. Bushnell, who suggest the name of "oil folliculitis" for the disease, have investigated the bacteriology of some oils which are commonly considered to be its cause, and have concluded that the most serious skin diseases are most probably due to the oil acting as a carrier of infectious material. To obviate infection, the most important precaution is the exercise of clean habits by the workman. Oils can be sterilised by heating to 70° C. for 20—30 minutes, but in practice it is not easy to keep them sterile and free from dust for any extended period. Researches by the staff of E. F. Houghton and Co. have shown that oils containing ichthyol and oils pressed from crude solid paraffin also produce skin lesions. According to these observers, the addition of germicides to the oils does not yield satisfactory results, but daily filtration and sterilisation of the used oils reduce the number of metallic particles present and the danger of bacterial infection.—(*J. Ind Hyg., June*, 1921.)

Aniline Poisoning in the Rubber Industry.—Aniline and some of its homologues have a toxic effect on the blood and the nervous system, producing symptoms associated with internal suffocation. The poison may enter the system through the skin, the respiratory tract and the alimentary canal; intoxication, however, mostly occurs through respiratory absorption. The following preventive measures, among others, are suggested:—Forced ventilation; handling of aniline and its compounds in closed receptacles; restricted time of working in fumes of aniline; and protection of exposed parts of the body from contact with the chemical and removing it at once if spilled on the skin or clothing. Sometimes vinegar is administered to the workers in order to produce a soluble compound of aniline which can be excreted through the kidneys. Dr. Davis recommends the use of lemonade containing Epsom salts, which promotes catharsis and diuresis. It is particularly noteworthy that alcohol consumption aids aniline absorption, especially in young persons. When the actual intoxication has already set in the patient must be treated for lack of oxygen and acidosis.—(*J. Ind. Hyg., June*, 1921.)

The Salt Industry in Curacao.—The manufacture of salt in Curaçao and the other islands of this colony, chiefly Bonaire and St. Martin, is an important industry which is carried on at comparatively small cost. The product, known as "sola" salt, is obtained by simple evaporation extending over 4 to 5 months. In Curaçao no attempt is made to separate the sodium chloride from the magnesium and potassium salts, although this is done at the Philipsburg salt ponds on the island of St. Martin. At present about 12 companies are producing sola salt in Curaçao, one of the largest of which owns the St. Nicholas estate, which has an area of about 490 acres, comprising 12 salt ponds, and produces about 40,000 barrels (of 286 lb.) per annum.—(*U.S. Com. Rep., Mar.* 28, 1921.)

Salt Production at Guerande, France.—The Guerande salt marshes, at the mouth of the Loire in southern Brittany, consist of 20,000 basins covering an area of about 7410 acres. The annual output is about 50,000 metric tons and the products are grey, washed, and refined table salt, also a snow-white quality which has the odour of violets. Two-thirds of the production is consumed locally and the remainder is sent into the interior.—(*U.S. Com. Rep., Apr.* 29, 1921.)

Sugar Production in the West Indies.—In each of the years 1916 and 1917 the West Indies and British Guiana exported approximately 300,000 tons of sugar, inclusive of syrup, in 1918 about 250,000 t., and in 1919 some 260,000 t. The exports in 1920 were as follows:—Jamaica 36,664 t., Trinidad 49,977, British Guiana 83,776, Barbados 51,805, Antigua 13,789, St. Kitts 10,406, Montserrat 135, St. Lucia 4657, St. Vincent 620; total 251,829 tons. Of the various colonies, Trinidad and Jamaica are likely to increase their production materially; the area under cultivation in British Guiana appears to be diminishing owing to labour troubles, but given favourable conditions it could supply the entire requirements of Canada for sugar. The estimated production of all the above colonies in 1921 is 249,383 tons.—(*Bull. Dept. Tr. and Com. Canada, May* 9, 1921.)

Consumption of Fertilisers in the British West Indies.—According to the statistics available, the annual importation of fertilisers and manures into the British West Indies is of the value of £583,817, comprising fertilisers, chiefly sulphate of ammonia and nitrate of soda, worth £524,302, and organic manures and mixtures worth £59,519; of this total Barbados consumed nearly one-half and British Guiana about one-third. Recent experiments have shown that the soil in Barbados requires hardly any phosphates, but more potash than had formerly been used. British Guiana usually imports about 14,000 tons of fertilisers per annum, mostly sulphate of ammonia, but in Jamaica there are local supplies of farmyard manure and guano, and consequently requirements, chiefly sulphate of ammonia and potash, are smaller. The sugar estates in Trinidad mostly import special mixtures from the United Kingdom, but basic slag, sulphate of potash and kainit are all used. Sulphate of ammonia, nitrate of soda, and nitrate of lime are imported for use in St. Kitts and Antigua, any compound fertilisers required being usually imported direct by the estates. The decrease in fertilisers imported into the Leeward Islands is due to the difficulty of obtaining those required by the sugar plantations. In Dominica, where potash is an essential, the imports of fertilisers are increasing. Montserrat now imports a negligible quantity of fertilisers. In the Windward Islands, Grenada imports 2000 t. of fertilisers, a favourite mixture consisting of 5 per cent. potash and 30 per cent. phosphates. At present St. Lucia obtains fertilisers from the United Kingdom and the United States in considerable quantities, but the requirements of St. Vincent are very small.

The imports in the last year for which statistics are available were as follows:—

Colonies.	Chemical manures. Tons.	Other manures. Tons.	Chemical manures. £	Other manures. £
Trinidad	—	—	31,801	3,184
Jamaica	—	—	9,839	338
Barbados	18,995	1,388	284,569	36,612
British Guiana	8,310	2,734	184,335	18,444
Leeward Islands	—	—	9,422	135
Grenada	15	242	67	802
St. Lucia	—	—	4,116	—
St. Vincent	—	—	153	—
Bermuda	—	—	13,150	—
Bahamas	—	—	513	—

—(*Bull. Dept. Trade and Com., Canad., Apr.* 18, 1921.)

Russian Metallurgy Under Soviet Rule.—The Quarterly Journal of the Russian Economic Association contains several papers dealing with the present condition of the metallurgical industry in Russia. The largest pre-war copper production was at the Kishtim works in the Urals, where in 1914 more than 32,258 long tons (2 million poods) of copper was produced. This fell off by about 20 per cent. during the first years of the war, and has now practically ceased, only a few small works being still in operation. Although deposits of zinc ore are found all over Russia, the production of zinc metal in 1914 did not exceed 1129 t., but works with a productive capacity of 48,387 t. per annum were begun in 1915 and, although not finished, produced 29,032 t. of metallic zinc by the end of 1917. The Revolution has arrested the completion of the works, but it is believed that, could they be started again, not only the home market but also foreign demand might be satisfied, especially as many of the Siberian zinc-ore deposits contain sufficient silver and gold to reduce the cost of production below that of the United States or Germany. Lead-ore mining was begun in Russia in 1704 and during the eighteenth century production steadily increased; it began to decline during the nineteenth century owing to the difficulties encountered in working the complex ores found in Siberia. In 1916, however, works for the production of more than 16,000 t. annually were erected at the Ekibastus mines, and mines were started in the Kirgis steppes, the Caucasus and the Urals. The completion of the South Siberian railway should open up a country rich in lead ores and with good coal deposits of which those at Ekibastus and Kuz-Chikinsk are already worked. The Russo-Asiatic Consolidated Co., Ltd., on completion of its projects, should be able to produce annually metals and minerals (including coal) to the value of over £40,000,000. In 1913 Russia produced about 56 per cent. of the total world's output of manganese but only 5 per cent. of its pig-iron. The large surplus of manganese ore supplied 65 per cent. of the total German requirements, and as in future Germany will have to rely entirely on Russian supplies, the future of the industry seems assured. The fuel crisis is the real cause of the delay in reconstruction, as the following figures for fuel consumption show:—

Year.	Consumption of coal. Long tons.	Consumption of wood. 1,000 cb. ft.	Year.	Consumption of coal. Long tons.	Consumption of wood. 1,000 cb. ft.
1916	24,552,758·1	5,837,517	1919	5,487,435·5	2,454,165
1917	—	4,474,778	1920	5,080,354·8	—
1918	—	3,257 471			

(1 ton=62 poods; 1 cb. sagene=343 cb. ft.)

The average monthly production of petroleum in 1920 was only 40 per cent. of that for 1913, and is still decreasing, being now even inadequate to meet the home demand. The output of pig iron has fallen from 4,651,581 long tons in 1913 to 44,113 t. during the first half of 1920; 520,000 workers are now employed. Many works have been closed, but the Government is running 21 so-called "storm" factories (employing 65,678 workers), whose duty is to reconstruct the disorganised transport system by intensified production and to form a nucleus for the revival of industry. These factories are given first call on supplies, but have been hampered by labour difficulties, especially absenteeism, due to the difficulty in getting food. The Communists have recognised the insolvency of their original system and now seek to introduce individual management, to create a labour army and to bind the men to the works. Unfortunately in applying these principles the works have been overstaffed with officials, of whom there are two to every three workers. Russia's only hope appears to lie in the reconstruction of her own national economy and the resumption of national work, aided by the investment of foreign capital when things have settled down.—(*Russo-Brit. Ch. of Comm. J.*, *Apr*, 1921.)

Metallurgy in Argentina.—Nearly all raw materials required in the metallurgical industry are imported, the domestic supply, in the absence of home-produced iron and copper, consisting mostly of scrap metals. Electrodes for electric furnaces, ferro-alloys, and refractories are also imported, but the manufacture of the last-named has been started in Buenos Ayres. There are three important steel works, Pedro Vasena e Hijos, Juan Pinoges, and the Cia. Industrial de Electricidad, of which the first two are operating Siemens-Martin furnaces and the last two 3-phase electric furnaces of 1½ t. capacity each. The Vesena plant consists of two furnaces, one of 20 t. and the other of 35 t., and of a 100-ton furnace now under construction; the Pinoges plant comprises five 20-t. furnaces. In addition, there are a few small steel-producers. The brass industry is not very important, as the total imports of brass and copper do not average more than 600 t. per annum, and the castings made are mostly of an ornamental nature; but brass and iron tubing are imported to a considerable extent. Aluminium castings are made only to replace broken parts, and the demand for this metal is very limited. Tinplate is used in large quantities for making containers, vats, cans, etc. The chief raw materials or semi-manufactures imported for use in the metallurgical industry in 1919 were as follows:—

	1919. Metric tons.
Brass and copper pipe, pigs, and sheets ..	1,283
Aluminium, pigs and sheets	26
Lead pipe, sheets and plates	5,235
Tinplate, sheets and cut	44,304
Tin, pigs and sheets	1,132
Iron and steel shapes, bars, plates, etc. ..	47,678
Iron, pig	4,785
Iron, galvanised	28,709
Zinc, pig, sheet and plate	1,043
Antimony, metal	51

—(*U.S. Com. Rep.*, *Apr.* 25, 1921.)

The Skoda Works in Czechoslovakia.—The present position of the Skoda works at Pilsen, the most important industrial enterprise in Czechoslovakia, is reported to be very unsatisfactory. During the war enormous quantities of guns, torpedoes, armour-plate, etc. were manufactured for the Austro-Hungarian Government, but since the armistice the plant has been gradually transformed to peace-time production. As Austria-Hungary was insolvent, foreign capital was appealed to and the French firm of Schneider and Co. invested large sums in the works, the capital being increased from 72 to 144 million kronen. The company, however, has not made the progress hoped for during the last 18 months. About 14,300 workers, including 4000 skilled munition workers and 1500 clerks, are employed at the works, which covers an area of over 441,000 sq. yds. The weekly wages amount to 4 million kronen and salaries to 600,000 kronen (krone=10d. at par, now about 0·1d.).—(*U.S. Com. Rep.*, *Apr.* 29, 1921.)

The Austrian Iron Industry.—It is reported from Vienna that the production of crude iron in Austria rose from 60,000 metric tons in 1919 to 120,000 t. in 1920, owing largely to increased imports of coal. Half of the production, however, had to be sent to Czechoslovakia under an agreement to supply iron in exchange for metallurgical coke. On account of the shortage of coke one company is said to be using charcoal.—(*U.S. Com. Rep.*, *Apr.* 27, 1921.)

PERSONALIA.

Prof. W. R. E. Hodgkinson, C.B.E., has been granted a Civil List pension in recognition of his valuable scientific work in the public service.

Dr. H. V. A. Briscoe has been appointed professor of inorganic and physical chemistry at Armstrong College, Newcastle-on-Tyne, in succession to Prof. P. Phillips Bedson, who has recently retired after 39 years' service.

The chair of applied chemistry at the Finsbury Technical College has been filled by the appointment of Mr. A. J. Hale, who has been associated with the College since 1910. In 1917 he was appointed chief assistant in the Chemical Department under Professor G. T. Morgan, and since 1919 he has been its acting head.

The following candidates have been successful in the recent examinations of the Institute of Chemistry and have been duly elected Associates:—*General Chemistry:* A. N. Campbell, J. J. Doolan, B. B. Evans, P. G. T. Hand, J. W. Jenkins, W. Pugh, B. F. Ridge, S. S. Woolf. *Metallurgical Chemistry:* G. P. Storer. *Organic Chemistry:* F. Kenyon, F. J. Sheldon. *Chemistry of Food and Drugs, etc.:* C. W. Martin, P. M. Mooney, E. Woodward. *Chemical Technology:* D. D. Smith (soap, etc), J. W. Whitaker (coke-oven practice, etc.).

The chair of chemistry in the University of Bonn, formerly occupied by Prof. R. Anschütz, has been offered to Dr. P. Pfeiffer, of the Technical "Hochschule" in Karlsruhe. The professorship in pharmacology at Kiel University has been offered to Prof. O. Gros, whose chair at Cologne has been filled by the appointment of Prof. Kochmann. Prof. E. Müller, of Heidelberg, and Engineer E. Diepschlag, of Cöthen, have been appointed professors of iron-smelting technology in the University of Cologne and at the Technical "Hochschule" in Breslau, respectively.

The death is reported of Prof. G. Lippmann, in his 76th year, who was professor of physics at the Sorbonne, Nobel prizeman in 1908, and president of the Paris Academy of Sciences in 1912. Prof. Lippmann was the author of a well-known process of colour photography (1891), and he did other valuable research work in the spheres of electricity, capillarity, and optics.

Prof. Ernst Schmidt, since 1884 professor of pharmaceutical chemistry in the University of Marburg and the author of much original work on the alkaloids, died on July 7, at the age of 76. The death is also announced, in his 67th year, of Prof. Th. Diehl who as chemist and deputy director of the A.-G. für Anilinfabrikation played an important part in the development of dyestuff technology, in particular of the direct cotton colours.

The death of Dr. H. R. Le Sueur, which took place on July 9 in his fiftieth year, will be widely regretted by members of this Society, which he joined in 1899, and particularly by the members of the London Section, among whom he was well known and warmly regarded. A notice of his life will be published in due course by the Chemical Society, to the Hon. Secretaryship of which he was re-elected last March, and at the meetings of which his loss will be keenly deplored. Dr. Le Sueur was a native of Jersey, and his whole professional career was associated with St. Thomas's Hospital, where for many years past he was Lecturer on Chemistry. During the war he served as Major, R.E., and unhappily developed the condition of health which destroyed his power of resistance to an attack of pneumonia.

PARLIAMENTARY NEWS.

HOUSE OF COMMONS.

Food and Drugs Act (Vinegar).

Mr. Carter asked if the Government intended to give effect to the recommendation in the Report on Vinegar of the Sub-Committee on Trusts, viz., that as brewed vinegar costs twice as much to produce as unbrewed vinegar, and as a purchaser cannot distinguish between them, the vendor should therefore be required to declare which kind is being sold. In reply, Sir A. Mond said that the purchaser can protect himself by asking specifically for brewed vinegar, in which case it would be an offence under the Sale of Food and Drugs Act should the vendor supply unbrewed vinegar. There was no statutory power to require the seller to make any declaration so long as the article sold fell within the description given by the purchaser, and he could hold out no hope of legislation on the subject in present circumstances.—(July 4.)

Glassware Trade.

Mr. Baldwin, answering Mr. C. Edwards, said that he was aware that the report on the glassware trade prepared by a sub-committee appointed under the Profiteering Acts contained the statement that the sub-committee did not consider that the profits made by members of the Northern Association of Pressed-Glass Manufacturers since the armistice were justified and that the necessity of Government supervision of such associations was urgent. The Government hoped to introduce legislation in respect of trade combinations, but it was not possible to indicate precisely the lines that would be followed.—(June 30, July 11.)

Palm Kernels.

Replying to Capt. W. Benn, Mr. Baldwin said that no differential export duty was imposed on palm kernels in mandated territories.—(July 11.)

Nauru and N. African Phosphates.

Sir A. Boscawen, in answer to Mr. Forrest, said that the Phosphate Commissioners had contracted with the South Wales Basic Slag Co., Ltd. for the supply of 125,000—215,000 tons of Nauru and Ocean Island phosphates between March, 1921, and the end of 1922; and that a provisional contract had also been made with the Slag Phosphate Co., Ltd. for the supply of the phosphate available for shipment between 1923 to 1927, with a minimum of 100,000 to 150,000 t. per annum. In each case the selling price was the cost price as laid down in the Nauru Island Agreement and the price at which the companies could sell was the cost price plus a moderate, agreed profit, so that agriculture would receive the fullest possible benefit. The entire responsibility for selling the phosphate lay with the Phosphate Commissioners, and the contracts made by them in no way concerned the Government. The Slag Phosphate Co. described the mixture it is placing on the market as slag-phosphate composed of about one-half of basic slag and the remainder Nauru and Ocean Island phosphates, so that there was no reason for agriculturists to suppose that the material was high-grade basic slag. Average analyses of Nauru and North African phosphates gave:—

	Naura phosphate. Per cent.	N. African phosphate. Per cent.
Tricalcium phosphate	85.28	63.35
Phosphoric acid	39.05	29.0
Lime	—	47.45
Carbon dioxide	2.29	18.05
Oxides of iron and alumina	(under) 1.0	1.5
Insoluble	—	4.0

The price of 3s. per unit charged for the mixture of basic slag and ground phosphate was understood to be based on cost price plus a limited profit, and compared favourably with current prices of superphosphate and basic slag.—(July 11.)

Reparation Dyes.

Sir W. Mitchell-Thomson, in reply to Sir W. Barton, stated that the total weight of synthetic dyes and colouring matters received from Germany under the Peace Treaty up to June 30 was 4053 tons, and the value credited up to March 31 was approximately 110 million paper marks, to which must be added cost of carriage, storage and distribution. The total sales, including those to India and the Dominions, amounted to about 1068 tons, valued at £710,643.—(July 13.)

Indian Monazite.

Answering Mr. Armitage, Mr. Montagu said that the arrangements made during the war for bringing supplies of Indian monazite sand under British control were still in force, and that no proposal to effect any change had, he believed, been before the Government of India.

Certain British manufacturers were directly associated with companies owning deposits, and the Travancore Minerals Co. was bound by the terms of its concession to sell monazite sand direct and at a fair price to any *bonâ fide* British firm that might desire to purchase the material in reasonable quantities and for purposes of manufacture, and had further undertaken to charge the same price for all purchases of lots of 10 tons and upwards.—(July 15, 18.)

Tungsten Ores.

Replying to Mr. Armitage, Mr. Young stated that no arrangements had been made to secure to the Empire supplies of tungsten ores, but some producers in this country owned wolfram mines within it. Since the armistice the Disposal Board had sold about 10,000 tons of tungsten ores (? concentrates), at a price which he would not disclose, and about 200 tons remained unsold.—(July 18.)

Oil-boring in the Midlands.

Mr. Baldwin informed Mr. Seddon that the Hardstoft well had been deepened to 3133 feet and had produced to date 233,855 gallons of high-grade crude oil. None of the other borings had struck oil in commercial quantities and several had been, or would shortly be, closed down. In other localities, including Apedale and Werrington (Staffs.), drilling was being continued until a decisive result was reached.—(July 18.)

Imports of German Dyes.

In a written answer to Mr. Gilbert, Mr. Baldwin gave the following statistics concerning the importation of dyes, dye-intermediates, etc., into the United Kingdom from Germany during the first six months of 1921:—Dye intermediates, 1686 cwt. (£20,218); finished dyestuffs obtained from coal tar, 33,562 cwt. (£694,200); extracts for dyeing, 189 cwt. (£2576); total, 35,437 cwt. (£716,994).—(July 18.)

Duty on Spirits.

A new clause, introduced by the Chancellor of the Exchequer, was added to the Finance Bill providing for an increase of 2d. to 5d. in the equalising duty on foreign spirits used for making power alcohol or in manufactures. The duty on foreign spirit will be 2s. 6d., but spirit produced within the Empire is duty-free if used for these purposes. Another new clause proposing to exempt from import duty articles containing spirits that are essential to British industries was withdrawn.—(July 18.)

REPORTS.

Report on the Commercial and Industrial Situation in Hungary, dated April, 1921. *By* R. J. E. Humphreys, *British Commercial Commissioner for Hungary. Pp.* 41. *Department of Overseas Trade. London: H.M. Stationery Office.* 1921. *Price* 1*s.* 3*d. net.*

Agriculture is the mainstay of Hungary and forms the basis of most Hungarian industries, of which the chief are milling, distilling, sugar-beet, hemp, and flax. There are also oil and petroleum refineries, and such manufactures as leather, paper, chemicals, textiles, rubber, iron and steel, cement, glass and porcelain. The output of manufactured articles, with few exceptions, does not meet home requirements, and raw materials such as timber, salt, iron ore, etc., formerly obtained in the country, are now in the hands of other States. The coalfields yield a poor quality of brown coal which has to be mixed with better material for industrial use; in 1920 the output was 4,956,285 tons (78 per cent. of the 1913 output), against an estimated requirement of 7,404,000 tons of coal and 450,950 tons of coke. Water power is available but has not been developed. Apparently, the partition of the former Monarchy has been disastrous to Hungarian industries which were formerly carefully fostered by the Government, but now, deprived of iron ore, timber, coal, oil, etc., their continued existence will be very precarious unless unrestricted supplies of raw materials can be obtained from neighbouring States. The economic outlook is serious but not hopeless, as the country has an excellent soil, an industrious peasantry, a favourable geographical position as a water-highway between West and East, and able administrators. Complete trade returns for 1920 are not available, but the chief products required include chemicals, machinery, hardware, and textiles. In 1913 the share of the United Kingdom in the foreign trade of Hungary was about 1·8 per cent. of the imports and about 3·4 per cent. of the exports. Prior to the war trade was transacted chiefly with Austria and Germany, but considerable amounts of sugar, and also paper, colours and tanning materials were exported to England, which, in return, supplied Hungary, *inter alia*, with coal, minerals, iron and steel, hemp, flax and jute.

General Report on the Industrial and Economic Situation in Greece, dated February, 1921, *By* E. C. D. Rawlins, *Commercial Secretary to H.M. Legation, Athens. Pp.* 66. *Department of Overseas Trade. London: H.M. Stationery Office.* 1921. *Price* 1*s.* 9*d. net.*

There are practically no chemical industries, properly so-called, in Greece, and the chief interest of the country to the chemical manufacturer lies in the raw materials found or grown there. Three magnesite deposits in the Island of Eubœa are worked by a British company which also produces caustic-calcined, and dead-burnt magnesite. The ore is calcined in vertical gas-fired kilns at Limni and Afrati, but owing to shortage of coal calcination was not restarted at Limni until late in 1920. The company's production in 1920 was 44,653 tons, of which 36,482 t. was sold and exported, mainly to Great Britain. The production of Naxos emery amounted to 11,000 t., valued at over 2 million drachmae (drachma = 10d. at par; max. value in 1920 = 10d., minimum 4½d.); 9829 t. was exported, 3373 t. to France, 2850 t. to Great Britain, and 1737 t. to the United States. There is a very productive chrome-ore mine near Pharsala from which 7324 t. of ore, worth about £28,000, was shipped to America in 1920. The output of marble, 1,302,945 tons, was much smaller than in pre-war years, but production is expected to increase in 1921 as Larissa and Skyros are to be opened up again. A British company owns eight marble deposits.

The olive harvest in Crete, Zante, and Patras appears to have been excellent, and the production of oil in Crete and Zante is estimated at about 98,000 metric tons. Practically the entire yield of opium from Macedonia is shipped to the United Kingdom and the United States. There were no exports of hides in 1920 owing to low prices; the principal kinds exported are goat, sheep and kid skins. Imports of hides, mostly of Abyssinian cattle and buffalo hides, amounted to nearly one million.

Economically, the year 1920 was far from satisfactory, owing mainly to political unrest and depreciated exchange. Germany is seeking to regain her former position in Greek markets. Large quantities of German wares, especially chemicals, dyes, machinery, paper, leather goods, etc., are now in the country and are being offered at prices from 40 to 60 per cent. below those of British goods.

During the past year a leading group of spirit merchants formed the Thessalian Spirits of Wine Co., Ltd., with a capital of about 1 million drachmae, to manufacture alcohol from raisins, figs, carob-beans, imported molasses, etc. Operations are expected to start next October and the anticipated production is 5000 litres per day of 24 hours.

Fifty-seventh Annual Reports on Alkali, Etc. Works. 1920. *By the* Chief Inspectors. *Pp.* 64. *H.M. Stationery Office*, 1920. *Price* 2*s. net.*

Since the retirement of Mr. W. S. Curphey, Mr. T. Lewis Bailey has been appointed Chief Inspector, and Mr. J. W. Young has been appointed Chief Inspector for Scotland, the inspection of works in Scotland being no longer under the supervision of the Chief Inspector for England, Wales and Ireland. During the past ten years the chemical processes coming under the jurisdiction of the inspectors have changed considerably, electrolytic methods for producing chlorine from brine and the ammonia soda process having become firmly established. By-product ammonia has provided many problems and much work has been done in connexion with the gases from sulphate of ammonia plants, the work on the direct recovery of ammonia having resulted in improved methods of desulphurising coal-gas.

During the year the grade "sub-inspector" was eliminated and the total inspection staff was reduced to seven. This entailed a rearrangement of the district areas; the whole of Wales with Ireland now forms a district, the old Cheshire and Lancashire district has been extended eastward, and practically a new area covering the N. and E. Midlands and part of Lancashire has been created with headquarters at Doncaster.

The total number of registered works in England, Wales and Ireland during 1920 was 1383, a decrease of 20 during the year. The number of separate manufacturing plants under inspection was 2241 distributed as follows:—Alkali: salt cake 46; copper (wet process) 17; cement 50; smelting 73; sulphuric acid 136, do. Class II. 105; chemical manure 141; gas liquor 92; nitric acid 76; sulphate and muriate of ammonia 631; chlorine 33; muriatic acid (other than alkali) 77; tinplate flux 70; salt 44; sulphide 92; alkali waste 5; Venetian red 10; lead deposit 37; arsenic 49; nitrate and chloride of iron 31; carbon bisulphide 5; picric acid 5; bisulphite 31; tar 372; zinc extraction 13. The numbers of sulphuric-acid, gas-liquor, and nitric-acid works have decreased to practically those of pre-war days.

Owing to the return of inspectors to full work, and to improved travelling facilities, the number of visits and tests made shows a considerable increase; although there have been infractions they were of short duration and not due to culpable negligence, and in no case was it considered necessary to prosecute.

The number of complaints from external sources was unusually large, but this is considered to be an after-effect of annoyance caused during the war period and suffered under protest. Visits of inspection are made direct to the working places without notice so that the inspector does not see operations under special conditions, as has been occasionally suggested. Chlorine has been responsible for several complaints, but points of difficulty have been promptly considered and improved working now prevails. There were complaints relating to the effect of acid fumes upon vegetation; the annoyance was probably accentuated by, and the alleged damage was probably partly due to, the abnormal rainfall during the early part of 1920.

The year was fairly free from serious accidents, but there were three fatalities in tar works. In one case a workman was overcome, probably by carbon monoxide, while clinkering the still fire, and in two cases sulphuretted hydrogen was inhaled during the cleaning of plant interior. There was one fatality during the cleaning of mixed-acid tanks, and it is suggested that this operation can usually be performed with a water-hose controlled outside the tank. If it is necessary to enter the tank it should be remembered that respirators afford little protection against nitrous gases.

Alkali Works.—Labour difficulties have been greater than usual in this industry. Inferior fuel has been responsible for inefficient distribution of heat in salt-cake furnaces and pots. To remedy this and to eliminate smoke, a supply of preheated tertiary air has been admitted to the fire through a 4-inch cast-iron pipe at such a point as secured the necessary indraught of air.

Cement Works.—Great activity is again reported in this industry; the output is restricted by inferior and uncertain fuel supplies and by the difficulty of completing repair work. Slow progress is being made in the recovery of potash from kiln dust.

Smelting Works.—Most of the works in the spelter industry have been idle. The De Spirlet furnace, a calciner with a number of superimposed hearths, alternate hearths being capable of rotation, has been introduced for the treatment of zinc blende with the possibility of the sulphurous gases being employed for acid manufacture. The deposition of dust close to the furnaces by electrostatic or other means is receiving attention.

Sulphuric Acid Works.—Good results both as regards nitre-consumption and exit-acidity have been obtained in a new plant, of which the chambers were all of the Mills-Packard conical externally water-cooled type. Owing to the saving of ground-space and materials of construction, greater importance is now being attached to intensive working. In the ordinary chamber-system, by the substitution of water-sprays for steam and by the consequent increased height of chambers, the chamber-space has been reduced to 8 cb. ft. per lb. of sulphur burnt per day, and a still further reduction is effected in the newer types of plant. This necessitates closer supervision and the need for efficient scientific control is urged. The use of the "Curphey" gas circulating injector has been extended, and is found to give a much more uniform drip from the chambers.

A considerable amount of oleum has been produced, and it is predicted that an increasing amount of high-strength vitriol will be made by contact processes. Attention needs to be paid to the removal of dust from burner-gases and to the treatment of exit-gases. A considerably reduced acidity of chimney-gases on a large concentration-plant has been achieved by the use of high-speed condensers.

Chemical Manure Works.—Many hand-dens have been replaced by mechanical dens, and in spite of more intensive work the condensation of noxious gases has been efficient. During 1920, 12,740 tons of guano, 523,350 tons of mineral phosphates and 147,477 tons of nitrate of soda were imported into the United Kingdom, all these quantities representing considerable increases on the previous year.

Sulphate and Muriate of Ammonia Gas-Liquor Works.—Many works have discontinued the manufacture of concentrated ammoniacal liquor, and increased attention is being paid to the production of dry neutral sulphate of ammonia. The total quantity of ammonia-products manufactured in the United Kingdom amounted to 418,881 tons (expressed in terms of sulphate containing 24·5 per cent. NH_3). There were complaints regarding the emission of sulphuretted hydrogen from one sulphate works, and improved working conditions have been obtained by the introduction of additional purifiers. Accounts are given of investigations upon the oxidation of ammoniacal liquor by air and upon the use of burnt oxide and wood charcoal as catalysts in the removal of sulphuretted hydrogen from gas.

Chlorine and Hydrochloric Acid Works.—There has been continued development of the manufacture of chlorine by electrolytic methods and of its use in the production of chlorinated organic compounds. Much attention has been paid to the treatment of tin scruff for the removal of zinc chloride before being furnaced. The scruff taken from tinning pots varies considerably, and may contain up to 20 per cent. zinc chloride. The ordinary washing of this is a lengthy process, and improved results have been obtained by plunging the scruff while hot into cold water in order to secure some disintegration of the mass. It has also been proposed to treat the scruff to a wet-grinding process for the removal of zinc chloride.

Arsenic Works.—A lengthy summary of the investigations and administrative work of Dr. A. C. Fryer in connexion with arsenic works is given. The provision of adequate depositing space and of wash-towers and limestone-scrubbers has resulted in a marked decrease in the arsenious and sulphur acids discharged into the air, in spite of the increased use of "mundic," which is essentially an arsenical pyrites. In addition, attention has been paid to the protection of flues and arsenic dumps, the disposal of effluent waters, and the treatment of ground impregnated with arsenic.

Tar Works.—Owing to the reduction in stocks of pitch, more efficient use of pitch coolers has become possible, and annoyance due to fumes has been reduced. The tar distilled during 1920 amounted to 1,568,323 tons, and the pitch produced was 740,763 tons.

An appendix to this Report contains a detailed account of the estimation of acid in soot and other carbonaceous matter.

Report on Scottish Works.—During 1920 there were 166 registered works in Scotland which operated 317 registered processes, including alkali (salt cake) 6, sulphuric acid 20, do. class II, 17, chemical manure 30, gas liquor 13, nitric acid 6, sulphate and muriate of ammonia 109, sulphide 14, lead deposit 13, nitrate and chloride of iron 6, paraffin oil 5, bisulphite 8, and tar 53. In no case were the statutory limits of noxious fumes exceeded.

The following data are given respecting raw materials and products during 1920:—Pyrites and spent oxide burned 144,117 tons, phosphates and bones dissolved 85,384 tons, salts of ammonia made (expressed as sulphate) 101,899 tons, tar distilled 245,097 tons, pitch 120,041 tons.

An unsuccessful attempt was made to absorb the nitrous gases in a sulphuric-acid plant by mechanical means instead of in the Gay-Lussac tower; it would appear necessary to improve the atomisation of the acid and to increase the time of contact. The raw material being used in manure works appears to be more difficult to grind than usual and in some cases entails the use of stronger acid; the proportion of silicon fluoride to be rendered innocuous is now greater. The average acidity of the escaping gases was equivalent to 0·19 grain SO_3 per cb. ft., compared with 0·09 grain in the previous year, and it is suggested that a more stringent interpretation of the Act in this respect may be desirable. At a sulphate of ammonia works increased output has been obtained by supplying superheated steam to the stills. At a tar works an extra manhole has been provided near the base of the stills in order to facilitate ventilation and to eliminate danger when cleaning is carried out.

[The more technical portions of this Report will be noticed in the Abstracts section of this Journal.]

COMPANY NEWS.

British Dyestuffs Corporation, Ltd.—The directors announce that in view of the unsatisfactory trading results for the half-year ended April 30, 1921, due to the general depression in the textile and other colour-consuming trades, they are unable to recommend the payment of an interim dividend on the preference shares in respect of that period.

Mining Corporation of Canada.—At the annual meeting held in Toronto on June 29, Mr. J. P. Watson, president, said that milling operations were resumed on May 25 and were being continued at full capacity, *i.e.*, 300 tons per day. Should the directors at any time decide to close down again, it would not be from lack of ore but to protect their interests. Present stocks of bar silver amounted to 650,000 oz., but sales were not being pushed in view of the prevailing low prices. Production from the cobalt properties had been satisfactory and recent important discoveries of new veins and stringers had added considerably to the ore reserves. The Corporation had acquired a controlling interest in the Flin Flon mine (copper, gold and silver) in Manitoba. The amount of proved ore on this property, which covered 1300 acres, was 16 million tons, and there was a further probable 9 millions.

Union Minière du Haut Katanga.—This company was formed in 1906 to operate 60,000 sq. miles of mineralised land in the Congo Free State for the Comité Spécial du Katanga (connected with the Belgian Government) and the British Tanganyika Concessions Co., Ltd. At the annual meeting held in Brussels on July 11, M. Jean Jadot announced a net profit of 10 million francs for the year 1920 (against 33 millions for 1919 and an average of 9 millions for the period 1914–18), the whole of which would be allocated to depreciation. The collapse in the price of copper, of which the company is producing nearly 3000 tons monthly, has been met by increased production and reduced working costs, for notwithstanding the low price of copper, receipts are covering all expenditure. It has been decided that the best method of extracting the copper from the great bulk of the ore is treatment with sulphuric acid, followed by electrolytic deposition. To effect this it will be necessary to develop the water-power resources, for which purpose it is proposed to increase the capital by 300 million francs. During the first six months of 1921 the output of copper was 13,030 t., obtained by the direct smelting of 17 per cent. ore. Cobalt, tin, coal, gold, platinum, palladium, and uranium are also found on the company's properties and some of them are being worked. Work done in 1920 has confirmed the presence of high-grade uranium ore containing radium which so far has only been found in the form of thin stringers and small pockets. When completed, the Benguella railway from the port of Lobito on the west coast of Africa to Katanga will have a great influence upon the development of the minerals in the Katanga belt; were it now ready the cost of production of copper would be lower by £20 per ton.

TRADE NOTES.

FOREIGN.

The German Export Trade in Coal-tar Dyes and Intermediates.—According to the latest official returns, Germany exported, in round numbers, 82,600 metric tons of dyestuffs and dyewares during the first 10 months of 1920 (against 224,000 t. in the corresponding period of 1913), which represented 39·4 per cent. of the total value of the exported chemical products. The following statistics indicate the extent to which the export trade in these commodities has fallen off, and also the directions in which the trade has been diverted:—

Countries of destination.	Aniline and other coal-tar dyes.		Alizarin dye.	
	1913.	1920.*	1913.	1920.*
	Metric tons.	Metric tons.	Metric tons.	Metric tons.
United States ..	13,855	338	2,656	144
United Kingdom ..	11,000	970	2,657	173
Austro-Hungary ..	5,800	741†	541	—
Italy	4,100	1,257	189	170
China	8,500	—	—	—
India	3,800	—	2,661	—
Japan	3,500	—	—	—
Dutch Indies ..	—	—	589	—
Belgium	2,500	790	—	—
Holland	1,400	1,047	325	215
France	1,400	670	222	193
Russia	1,100	—	329	—
Sweden	900	893	—	500
Switzerland ..	784	463	—	50
Spain	656	447	—	—
Brazil	626	—	—	—
Mexico	543	—	—	—
Canada	443	—	—	—
Turkey	437	195	—	—
Portugal	418	—	—	—
Norway	270	226	—	—
Denmark	237	216	—	—
Finland	236	194	—	—
Czechoslovakia ..	—	2,335	—	—
Alsace-Lorraine ..	—	138	—	—
East Poland ..	—	375	—	—
East Asia	—	1,250	—	—
S.E. Asia	—	500	—	1,333
All other countries .	—	—	—	413
Total exports ..	64,288	14,470	11,040	2,810

* 10 months. † German Austria.

In the period January—October, 1920, the total exports of naphthalene, anthracene, anthraquinone, phenol, cresol, carbolic acid, naphthol, naphthylamine, nitrobenzene, toluidine; resorcin, and phthalic acid amounted to 1573 tons, of which the United States took 418 t., Switzerland 305 t., Holland 116 t., Sweden 75 t., France 65 t., and Italy 38 t. In 1913 the chief importing countries for naphthol and naphthylamine were Russia (1117 t.) and the United States (638 t.); and for anthraquinone, nitrobenzene, etc., Switzerland (1201 t.), Russia (998 t.), United States (965 t.), Italy (825 t.), and France (776 t.).

Of aniline and aniline salts 478 t. was exported in 1920 (10 months), mainly to Czechoslovakia (113 t.), Italy (120 t.), Austria (55 t.), and France (43 t.). In 1913 (12 months) the total export was

7265 t., of which the United States took 2428 t., Switzerland 1217 t., Austro-Hungary 655 t., and Russia 602 t.

In the above statistics the exports to England, France, Italy, and Belgium include the deliveries under the Treaty of Versailles; and of the exports to Holland it is known that large quantities found their way to England, France, United States, and East Asia.

Norwegian Trade in 1920.—Statistics issued by the Norwegian Government Satistical Bureau show that importations decreased during the latter part of 1920, and that although exports of timber, cellulose, paper, and fertilisers were larger than in pre-war years, as a whole they were considerably below the pre-war level. The chief imports and exports of chemicals, etc. in 1913 and 1920 were as follows:—

		1913.	1920.
		Metric tons.	
Imports:—			
Olive oil		1,091	1,010
Linseed and rapeseed oils, etc.,		862	711
Coconut oil		3,651	11,918
Cottonseed oil		5,136	9,598
Oilcake		30,173	12,702
Petroleum, etc.		79,281	65,529
Gasoline		993	19,550
Lubricating oils and greases		30,173	12,702
Coal, coke, etc.		2,527,000	1,827,000
Salt		214,987	141,479
Potash and fertilisers		21,084	16,924
Fxports:—			
Condensed milk		19,478	4,613
Hides and skins		5,944	2,952
Cod-liver oil	hectolitres	46,000	49,000
Whale, fish and seal oil	,,	222,000	119,000
Lumber and wood products	cb. metres	1,035,960	938,695
Wood pulp, wet		481,080	376,323
Cellulose, dry		209,544	211,291
Paper, print, wrapping, etc.		180,529	184,647
Iron ore, concentrates, etc.		558,623	225,774
Pyrites, ores, etc.		460,436	316,531
Calcium nitrate		70,171	117,439
Calcium cyanamide		22,111	15,915
Calcium carbide		66,876	31,367
Ferro-silicon		0,326	11,914
Matches		5,514	2,371

(*cf.* J., 1921, 93 R).—(*U.S. Com. Rep., Apr.* 20, 1921.)

OFFICIAL TRADE INTELLIGENCE.

(*From the Board of Trade Journal for July* 14 *and* 21.)

TARIFF. CUSTOMS. EXCISE.

Australia.—Recent customs decisions affect potassium and sodium cyanides, hydrosulphites, sulphur, pyrites, soda crystals, alum, alum cake, sulphite of alumina, alumino-ferric, copper sulphate, potassium chlorate, certain drugs, leather, and synthetic perfumes.

British India.—The revised lists of import and export tariff valuations are set out in the issue for July 14. Among the articles affected are coconuts, spirits, perfumes, vinegar, sugar, resins, gums, oils, petroleum, waxes, many chemicals, drugs and dyes, glass, leather, iron, steel, metals, paper, cardboard, candles, matches, tar, pitch, and soap.

Egypt.—The customs duties on alcoholic beverages and perfumes have been revised.

France.—The schedule of "coefficients of increase" has been revised. Increased coefficients have been applied to, *inter alia*, animal wax, vegetable oils, alabaster, slate, sulphur, paraffin wax, vaseline, certain metals and chemicals, prussian blue, inks, colours, dextrin, casein, candles, wax, glass, porcelain, certain kinds of paper and cardboard, prepared hides and skins, wares of metals, rubber, gutta percha, asbestos, mica, and laboratory glassware.

French Indo-China.—Medicinal substances of extra-European origin for the manufacture of essences and perfumes are admitted duty-free. Such substances for other purposes pay duty at the rate of 60 fr. per 100 kg.

French West Africa.—The "coefficients of increase" have been modified on alcohol, petroleum, skins, palm oil, palm kernels, gum arabic, and charcoal.

Germany.—Modified import duties are payable on tanning barks, woods and extracts and certain other tanning materials.

Italy.—The new customs tariff which came into force on July 1 is issued as a supplement to the issue of July 21. The schedules set out the duty payable, together with the appropriate "coefficient of increase," which rarely exceeds unity. The duty is payable on a gold basis, and if paid in bank certificates or paper money is subject to an "Agio." Import duties affect practically all classes of goods, but export duties are payable on only a few articles which include metallic ores, burnt pyrites, zinc ashes, raw bones, tartar, and rags.

Poland.—Importation of aniseed, coriander, vanilla, and condensed milk is now permitted.

Rumania.—The import is allowed of leather for the manufacture of portmanteaus and of glycerin soaps.

South Africa.—Increased import duties are payable on perfumed spirits and on medicinal and toilet preparations, essences, syrups and tinctures containing more than 3 per cent. of proof spirit.

Switzerland.—All goods may now be exported under general export licence with a few exceptions which include scrap and waste iron and precious metals.

Syria and Lebanon.—The export is prohibited of gold, silver, platinum, lead, building material, and charcoal, etc.

Among the prohibited imports are opium, hashish, cocaine, saccharin, sulphonal, picrotoxin, picrates, nitroglycerin, potassium and sodium chlorates.

Uruguay.—Export prohibitions have been removed from, *inter alia*, unworked metals, metal waste and scrap, iron, steel, copper, tin, lead, zinc, aluminium, antimony, and imported medicines, industrial chemicals, colours, paints and varnishes.

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W. 1, from firms, agents or individuals who desire to represent U.K. manufacturers or exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department and quoting the specific reference number.

Locality of firm or agent.	Materials.	Reference number.
United Kingdom	Chemicals	21
British West Indies	Chemicals, paper (catalogues of)	54/D.O.T./6083/E.D. S.C. 2
Egypt	Brass, lead and zinc sheets, iron, steel (tender for)	—
New Zealand	Pig, bar and sheet iron	67
South Africa	Glassware	33
Belgium	Calf leather	34
Czechoslovakia	Heavy and pharmaceutical chemicals, oils	46
Hungary	Druggists' goods	73
Italy	Sheet copper	11199 F.W./P.N
Spain	Chemical and pharmaceutical products	44
,,	Metals, oilseeds	77
China	Metals	47
United States	Chemicals, dyes, oil, tallow, hides, skins	50
Argentina	Bottles, glass tubes and measures	51
,,	Drugs	82

REVIEWS.

Oils, Fats, Waxes and their Manufactured Products. *By* Alder Wright *and* C. Ainsworth Mitchell. *Third edition, revised and enlarged. Pp.* xiii.+939. (*London: Charles Griffin and Co., Ltd.* 1921.) *Price* 56*s. net.*

This is a third edition of Dr. Alder Wright's well-known book, first published in 1893. The literature in this particular field is so large that a selection from the mass of available material is necessary, especially from the point of view of the reader who nowadays finds it increasingly hard to obtain the information he wants from reference works containing a thousand pages and upwards. An ample index, text- and page-headings and expanded contents are all of assistance if easy reference is to be facilitated; on the whole the book is satisfactory in this respect, though it lacks an authors' index. The scope of the work has been but little altered—it embraces in turn the general composition, physical and chemical properties of oils and fats, the processes used for extracting, refining and bleaching them, their classification and uses, and then deals specifically and at some length with the candle industry and the soap industry, including the manufacture of glycerin.

The more purely chemical portion runs on conventional lines, but great pains have been taken with the essentially technical portion, the value of which is enhanced by diagrams and illustrations. All the patented and advertised processes receive full recognition, but no guidance is given to the student as to which of these are successful in practice. Such a method of treatment is common to books of this class, but it leads to the unfortunate result that in some instances processes are described at length which are known to be a failure in practice; the reader is in no way guided as to which are the really practical processes commonly in use in the industry. Although in some industries it is difficult to obtain information concerning the processes in operation, this is far from being the case generally. The bad influence of this state of affairs on our educational system is obvious, and whilst one would not wish the writer of a technical monograph to be a partisan, he should equally avoid being misled by what is largely special pleading. It is not intended to imply that Mr. Mitchell's book is specially defective from this point of view, but a perusal of recent technical literature has convinced the reviewer that the subject requires ventilation.

Any criticism in detail of such a work is impossible, and it may be confidently stated that the new edition will enjoy the same high reputation as its predecessors. Needless to say, it has been brought fully up to date in all that concerns the technology of oils and fats.

E. F. Armstrong.

Rapid Methods for the Chemical Analysis of Special Steels, Steel-making Alloys, their Ores and Graphites. *By* C. M. Johnson. *Third edition, revised and enlarged. Pp.* 552. (*New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.* 1920. *Price* 36*s. net.*

New editions of old works have of late so often proved to be but reprints, with the addition of a useless appendix presumably added to bring the book up to date, that it is with relief that one turns to Mr. Johnson's third edition, for this volume contains not only the useful material of the past editions, but also over one hundred pages of new matter. The new introductions, which are cited in the appendix under thirty-two headings, include a number of valuable new methods, many evolved by the author himself. The greater part of these deal with estimations of the rarer elements, such as uranium, tantalum, cerium, zirconium, boron, etc. One does not hesitate to say that when dealing with these more special elements the author gives one the impression that he is an expert, as no method is suggested which has not been fully tried and worked out by himself.

A new evolution-method for sulphur strikes one as being particularly good. This consists, briefly, in heating a finely-divided sample (in a tube-furnace) in a current of hydrogen saturated with hydrogen chloride, and collecting the hydrogen sulphide evolved by means of ammoniacal cadmium chloride. This method, of which precise details are given, is stated to give results far more reliable than those obtained by the evolution-method commonly employed. The author's method of estimating chromium and vanadium by first removing the bulk of the iron with ammonia strikes one as being as good as it is simple.

One new feature open to criticism is the added chapter on the micro-examination of steel. This, although well written, is too brief to be of great use. The custom nowadays for books on chemical analysis of steel works to include a chapter on micro-analysis is difficult to support; an account of the methods of polishing and preparing specimens for the microscope cannot in itself make a microscopist. There are special publications written exclusively on this subject, and it would have been better to have omitted this chapter altogether rather than to have given the analyst the impression that metallography is a science requiring manipulative skill rather than power of deduction and interpretation. The great feature of Mr. Johnson's book as a whole lies in the atmosphere of enthusiasm that pervades its pages; he uses chemical analysis not only to arrive at the ultimate composition of matter but also to derive other facts, such as correctness of annealing, condition of carbon, etc. One is in doubt, however, concerning his definition of the term "annealing," and his methods for softening certain special steels would leave one in a state of scepticism but for the fact that he gives these not as suggestions but as methods tried and proved.

Not only should the third edition, with its valuable additions, be on the book-shelf of every steel-works' analyst, but the contents should be in his mind.

J. H. Andrew.

Analysis of Paint Vehicles, Japans, and Varnishes. *By* C. D. Holley. *Pp.* 203. (*New York: J. Wiley and Sons, Inc.; London: Chapman and Hall.* 1921.) *Price* 13*s.* 6*d. net.*

The book opens with a good account of the petroleum thinners, followed by turpentine, alcohol, acetone, benzol, used as turpentine substitutes in the varnish and paint trade. A very elaborate scheme for determining the boiling-points of these products is given, which is much too complex for ordinary laboratory practice. Linseed and other oils used as substitutes are then discussed, but unfortunately the iodine-value figures have been determined, as is commonly the case in America, by the Hanus method, and are thus too low, and not comparable with the iodine-values obtained by the European Wijs method or by that of Hubl (properly performed). The hexabromide test is very fully described as estimated on the free acids of the oils, whereas in this country it is now more commonly done on the glycerides themselves. Tung oil is then described, and little more of interest is found in the chapter except the directions for carrying out the iodine-jelly-test and Browne's heating-test.

Interesting processes for obtaining the vehicle from mixed paints and its examination are given, and also a chapter on the estimation of thinners, water, and emulsions in paints. The chapter on the analysis of liquid driers and japans should prove useful to the average chemist. Shellac and spirit varnishes are then discussed. Why the author here adopts Wijs's solution for the iodine-value instead of Hanus is not explained; the reviewer would prefer to use Hubl's method because of the greater solubility of the lac in alcohol than in acetic acid. Since it is agreed that the iodine-value forms the best method for estimating resin in shellac, yet there is no mention of a simple process which the reviewer has found to be approximately accurate, and which is based upon the insolubility of shellac and the solubility of resin in coal-tar benzol.

The book contains a number of empirical tests, which are little known; they may be good in expert hands, but to-day one looks for reasons. One regrets to find that the whole volume is scientifically out of date, and shows but little acquaintance with the European literature of the last twenty years. The book suggests an expanded edition of a portion of Holley and Ladd's "Analysis of Mixed Paints, etc." of 1908.

Harry Ingle.

Condensed Description of the Manufacture of Beet Sugar. *By* Franz Murke. *Pp.* 175. *(New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.,* 1921.) *Price* 15*s. net.*

The author describes the manufacture of beet sugar with special reference to the conditions that obtain in the United States, following the process from the harvesting of the beetroots to the production of white sugar. Very little raw beet sugar is made in America, and hence this branch of the industry, so important in European factories, is not treated at length. The various difficulties that are liable to occur in the different stages of manufacture are pointed out and the means for avoiding or overcoming them are indicated. Chapters are devoted also to the desaccharification of molasses by Steffen's process and by osmosis, to the management of the lime kiln, and the book concludes with data and tables likely to be required in sugar-factory control.

It would not be fair to compare the book with the larger treatises on the subject, and on the whole the author has succeeded in giving a comprehensive survey in a brief, readable style. He indicates in the preface that the book is intended chiefly for "superintendents, engineers, and foremen of the beet-sugar industry," and this perhaps justifies the absence of illustrations or diagrams of plant used in the factory. It would be difficult for anyone not acquainted with sugar-factory work to visualise such parts of the plant as the diffusion battery or the filter presses from the textual description. The book, too, would appeal to a wider circle of readers if such technical terms as "purity," "fillmass," "green syrup," "high wash syrup," were explained when first used; as it is, the significance of these terms is left to be explained or inferred from later pages. The chemical reactions involved in the carbonation (carbonatation) process are not sufficiently explained, and the explanation that is given (p. 30) of the alteration in the alkalinity of the juice during this process is mystifying rather than enlightening.

The book is somewhat disfigured by a number of careless slips. For example, the author seems doubtful as to the spelling of "cossettes," which appears as "cosettes" not less than five times; he speaks of "mechanical help" (p. 11, line 16) where "manual help" is no doubt intended; the sentence on p. 26, lines 24—5, should appear at the end of the preceding paragraph; and in the calculation on p. 112, the figure 65,200,000 (line 7) should read 75,200,000. These errors do not, of course, appreciably lessen the value of the book, which at least will serve as a useful introduction to a large and complex subject.

Lewis Eynon.

Kelly's Directory of Merchants, Manufacturers and Shippers of the World. 35*th edition in* 2 *volumes. Vol. I, pp.* 2670; *Vol. II, pp* 1868. *(London: Kelly's Directories, Ltd.* 1921.) *Price* 64*s. net.*

The preparation of this new edition has involved the making of over 600,000 alterations in trade references alone. Details are given concerning every trading country in the five Continents, and the information under the headings Chemical Exporters and Importers, Chemical Products, Chemical Merchants and Manufacturers, etc. will be especially helpful to those who are interested in chemical industries. Among the new features are outline maps of the principal countries, and the inclusion of telephone numbers in the British section.

Technical Records of Explosives Supply, 1915—1918.—The following reports are in the press and will shortly be issued by the Department of Scientific and Industrial Research:—No. 3. Sulphuric Acid Concentration. No. 4. The Theory and Practice of Acid-Mixers. No. 5. Manufacture of Sulphuric Acid by the Contact Process.

PUBLICATIONS RECEIVED.

Textile Design and Colour. *By* William Watson. *Second edition. Pp.* 436. *(London: Longmans, Green and Co.* 1921.) *Price* 21*s.*

Fundamental Principles of Organic Chemistry. *By* Charles Moureu. *Authorised translation from the sixth French edition by* Walter T. K. Braunholtz, *with an introduction by* Sir William Pope. *Pp.* 399. *(London: G. Bell and Sons, Ltd.* 1921.) *Price* 12*s.* 6*d.*

The Electric Furnace. *By* J. N. Pring. *Monographs on Industrial Chemistry, edited by Sir Edward Thorpe. Pp.* 485. *(London: Longmans, Green and Co.* 1921.) *Price* 32*s.*

Physical Chemistry for Colleges. *By* E. B. Millard. *Pp.* 411. *(New York and London: McGraw-Hill Book Co., Inc.* 1921.) *Price* 21*s.*

Engineering Steels. *By* Leslie Aitchison. *Reconstructive Technical Series, edited by G. W. de Tunzelman. Pp.* 396. *(London: Macdonald and Evans.* 1921.) *Price* 25*s.*

Tests on Volumetric Glassware used in Dairy Chemistry. *Pp.* 14. *Metrology Department. National Physical Laboratory, Teddington, Middlesex.* 1921. *Price* 6*d.* *(Single copies, free).*

Journal of Indian Industries and Labour. *Vol. I., Pt.* 2. *Published by order of the Government of India. (Calcutta: Government Printing Office.* 1921.) *Price Rs.* 1-8.

Publications of the United States Bureau of Mines. *Department of the Interior. (Washington: Government Printing Office.* 1921):—

Some Principles Governing the Production of Oil Wells. *By* Carl H. Beal *and* J. O. Lewis. *Bulletin* 194. *Price* 10 *cents.*

Gas Masks for Gases Met in Fighting Fires. *By* Yandell Henderson. *Technical Paper* 248. *Price* 25 *cents.*

CANADA AS A MARKET FOR BRITISH CHEMICAL PRODUCTS.

The stimulus of the late war did much to advance the chemical industries of Canada, whose development has been, and will be, greatly facilitated by the possession of a rich variety of raw materials and cheap hydro-electric power. According to the Census of Industry for the year 1918, the total domestic output of chemicals and drugs was valued at $38,252,587, the capitalisation of the manufacturing firms was $26,029,530, and the wages or salaries paid to 4292 employees amounted to $5,872,947. Nevertheless, the Dominion has continued to import large quantities of chemicals and allied products. In 1918–19 the total import trade was valued at $34,282,647 (much of which was in respect of war purchases); in 1919–20, the first "peace" year, the value dropped to $29,886,102; but last year it rose to $36,334,612.

Although the share of the United Kingdom in the Canadian chemical market has been gradually rising during the past three years (from $3,397,095 in 1918–19 to $4,154,345 in 1919–20, and to $6,037,185 in 1920–21), the bulk of the trade is still held by the United States; imports of American-made chemical products, which amounted to $28,719,765 in 1918–19, reached only $23,854,300 twelve months later, but rose last year to $26,787,896. In 1920–21 "other countries" secured sales amounting to only $3,509,531, as compared with $1,877,457 in 1919–20 and $2,165,787 in 1918–19. Thus it is clear that in a market worth about £9,000,000 at current rates of exchange, British goods have mainly to compete with those from the United States which are sold under advantageous geographical conditions, but under the disadvantage of higher rates of duty and with an exchange situation unfavourable to American exporters.

This exchange situation will demand very careful attention during the next few months as, owing to the effective embargo placed by the new American Emergency Tariff upon imports of Canadian agricultural products into the United States, an export trade recently worth about $160,000,000 per annum will be diverted from the United States to other markets, including the United Kingdom. A powerful support to the Canada-America exchange is thus removed, and it is very doubtful whether the present level of 12 to 15 per cent. from parity will be maintained when the expected general revival of purchasing gathers momentum after the harvest. The diversion of these exports of farm and dairy produce to British and European markets would also affect the value of the sovereign in Canada, and with the resumption of eastward shipments on a large scale next autumn the exchange rates should respond to the advantage of those British exporters of chemicals and allied products who have studied the market and who have been able to persuade wholesalers in the Dominion to replace goods hitherto obtained from America by competing lines from Great Britain.

The decision of the Canadian Customs authorities to value American goods for duty, not as hitherto on the face-value stated on the invoice, but on that value (in American dollars) *augmented by the exchange margin on the date of shipment*, adds forthwith an additional burden of 15 per cent. to the amount payable in duties, but imports from the United Kingdom are valued for duty on a basis conceding the importer the full benefit of the depreciation of British currency. For instance, British goods valued at £100 on a day when the rate of exchange is $4=£1 are assessed, not on their face-value, but on £100×4÷4·866, or £82 3s. 10d., whereas American goods valued at $100 and shipped on a day when the exchange margin reached 15 per cent. would incur duties at General Tariff rates assessed on $115 instead of on their face-value. Should these exchange rates fluctuate to the extent anticipated, the measure of advantage to the British competitor will be all the more apparent, and the conditions outlined should induce those firms which have hitherto not been interested in the Canadian market to examine the situation and get into touch with Canadian importers who are now purchasing mainly from the United States.

Details of the Canadian import trade in chemical products during the fiscal year ended March 31 last are as follows:—

	Total Imports. $	Imports from U.K. $	Imports from U.S.A. $
Acids of every kind	892,197	404,358	459,690
Drugs, medicinal and pharmaceutical preparations	3,457,913	1,307,077	1,679,047
Dyeing and tanning materials	6,031,566	818,241	4,447,808
Aniline dyes	2,997,689	555,332	2,267,112
Logwood, &c., extract	1,890,940	1,658,814	1,244,013
Explosives	750,385	296,040	430,178
Cellulose products	1,420,374	41,725	1,370,429
Fertilisers	4,272,054	172,056	3,347,793
Paints, pigments and varnishes	4,251,620	509,128	3,513,581
Soaps	1,424,446	103,883	1,244,677
Perfumery, cosmetics, etc.	1,202,585	94,487	470,763
Inorganic chemicals, not otherwise provided for	7,400,430	858,222	6,280,060
Other chemicals and allied products	5,231,042	1,431,968	3,543,870
	36,334,612	6,037,185	26,787,896

NITROGEN PRODUCTS.

In our review of the Report of the Nitrogen Products Committee, published early in 1920 (*cf.* J., 1920, 25 R), the earnest wish was expressed that the Report might be officially revised from time to time to keep it up-to-date, so that it might remain, as it then was, *the* work of reference on the subject. It is therefore gratifying to note that this policy has been adopted and that the Department of Scientific and Industrial Research has published a supplement to the original Report* giving statistical information concerning the nitrogen industry during the latter part of the war and down to the end of 1920. The data now published have been derived from official sources, wherever this has been possible, and every care has been taken to secure accuracy in regard to less authentic information; the result is a very valuable document which completely achieves the object with which the work was undertaken and which reflects great credit upon Dr. J. A. Harker and his colleagues, Messrs. T. K. Brownson and S. H. Groom. The scope of the Supplement is sufficiently indicated by an enumeration of the title-headings:—Demand for Fixed Nitrogen; The Chile Nitrate Industry; The Saltpetre Industry; The Nitric Acid Industry; The By-product Industry; The Synthetic Ammonia Industry; The Norwegian Fixation Industry; The Cyanamide Industry; The Ammonia-Oxidation Industry; The Fertiliser Industry; Miscellaneous Statistics; and British Developments in Nitrogen Fixation. There are, in all, 29 statistical tables from which, for the most part, the reader is left to draw his own conclusions, but the main points stand out in sufficiently bold relief; these are, (1) the fixation industry is now the largest contributor to the nitrogen requirements of the world; (2) the demand for fixed nitrogen is growing at a greater rate than the output capacity; (3) the potential output of the cyanamide plants is greater than that of synthetic-ammonia plants; (4) the backward state of the fixation industry in this country and Empire. A few of the more important statistical tables are reproduced below:—

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* Statistical Supplement to the Final Report of the Nitrogen Products Committee of the Ministry of Munitions. Compiled by J. A. Harker. Department of Scientific and Industrial Research. Pp. 22. (London H.M. Stationery Office. 1921.) Price 1s. net. (Copies are obtainable at H.M. Stationery Office, Imperial House, Kingsway, W.C.2.)

WORLD'S RESOURCES IN NITROGEN PRODUCTS.

Pre-war and post-war period contrasted.

	1912.			1920.		
Source of supply.	Output in long tons of product.	Output in metric tons of nitrogen.	Percentage of total output.	Productive capacity. Long tons of product.	Productive capacity. Metric tons of nitrogen.	Percentage of total productive capacity.
Chile nitrate industry (assumed 95 % product)	2,586,975	411,329	57·5	2,966,061*	471,000	30·2
By-product industry (sulphate assumed 24·5 % ammonia)	1,229,773	272,007	38·0	2,015,440	413,000	26·6
Fixation industry:—						
(*a*) Cyanamide (assumed 18 % N.)	126,538	22,435	3·1	1,777,000	325,000	20·9
(*b*) Nitrate of lime and arc process products (assumed 13 % N.) ..	75,000	9,907	1·4	290,400	38,300	2·5
(*c*) Synthetic ammonia	Nil	Nil	Nil	1,503,000	308,000	19·8
Total of fixation industry ..	201,538	32,342	4·5	3,570,400	671,300	43·2
Grand total	4,018,286	715,678	100·0	8,551,900	1,555,300	100·0

* The figure inserted here to represent maximum capacity of the Chilean nitrate industry is the maximum war output in a single year, which was for 1917.

NATIONAL PRODUCTION OF CALCIUM CYANAMIDE DURING THE WAR PERIOD.

Country.	Metric tons.						
	1913.	1914.	1915.	1916.	1917.	1918.	1919.
Germany	48,500	66,000	73,700	170,920†	183,100†	178,000†	—
Austria-Hungary ..	7,500	(24,000)	(24,000)	(24,000)	24,000	24,000	—
France	7,500	(7,500)	(80,000)	(100,000)	100,000	100,000	—
Italy	14,982	15,556	25,292	25,105	12,300	15,000	—
Norway	22,110	14,670	25,000	26,409	182,387	178,472	—
Sweden	18,352	18,000	16,363	18,000	17,613	21,528	—
Switzerland	7,500	(7,500)	(12,500)	(29,500)	40,000	40,000	—
Canada	48,000	(58,000)	(58,000)	(58,000)	58,000	58,000	65,317
United States	—	—	—	—	—	3,000‡	3,500‡
Japan	7,000	11,171	30,278	33,462	50,802	50,802	—
Total	181,444	222,397	345,133	485,396	668,202	668,802	68,817
Equivalent combined nitrogen on basis of nitrogen content of 18 % ..	32,660	40,031	62,124	87,371	120,276	120,384	12,387

* Figures in brackets indicate estimated productive capacity rather than actual output.
† Probably does not include cyanamide used as a source of ammonia for munition purposes.
‡ Production commenced just prior to the armistice.

NATIONAL INTERNAL SOURCES OF FIXED NITROGEN.

Estimated maximum production in 1920.

Country.	Population.	Metric tons of nitrogen.					
		From by-product sources.	From fixation plants.			Total.	Tons nitrogen per million population.
			Arc.	Cyanamide.	Synthetic ammonia.		
Germany	65,000,000	150,000	4,000	120,000*	300,000	574,000	8,830
Norway and Sweden ..	8,000,000	—	30,000	28,000	—	58,000	7,250
United Kingdom ..	45,000,000	100,000	—	—	—	100,000	2,240
Canada	7,200,000	3,000	800	12,000	—	15,800	2,200
Switzerland	3,800,000	—	700	7,000	—	7,700	2,030
France	40,000,000	15,000	1,300	58,000	—	74,300	1,850
United States	103,500,000	105,000	300	40,000	8,000	153,300	1,480
Austria	51,000,000	10,000	—	22,000	—	32,000	630
Italy	35,000,000	3,000	1,200	18,000	—	22,200	630
Other countries	—	27,000	—	20,000	—	47,000	—
Total	—	413,000	38,300	325,000	308,000	1,084,300	—

* This figure is stated by some authorities to be much too low. Certain sources of information give it as high as 200,000. Even on the basis of this lower estimate, the cyanamide process is still the largest contributor to the world's nitrogen supply by fixation methods.

EXPORTS OF NITROGEN PRODUCTS FROM NORWAY.

Synthetic products.	Metric tons.						
	1914.	1915.	1916.	1917.	1918.	1919.	1920.
Nitrate of lime	75,176	38,608	46,001	35,932	53,625	63,880	117,439
Sodium nitrite	8,907	7,395	6,109	3,536	2,098	1,894	7,697
Ammonium nitrate ..	11,959	26,459	59,639	63,578	49,588	5,163	20,244
Calcium cyanamide ..	13,719	24,609	13,152	2,313	10	9,930	15,914
Sodium nitrate	—	—	13,233	22,711	2,637	13,036	18,641
Nitric acid	—	—	—	1,621	837	1,433	—

DATA CONCERNING SOME TYPICAL AMMONIA-OXIDATION PLANTS.

Plant.	Location.	Source of ammonia employed.	Catalyst employed.	Annual capacity.	Approximate production.	
					Tons of product.	Tons of N.
(1)	Germany	Synthetic ammonium sulphate and gas liquor.	Activated iron oxide.	About 35,000 tons N.	About 80,000 tons nitrate of soda and 15,000 nitric acid (as 100 %)	About 16,000.
(2)	Germany	Gas liquor, ammonia liquor from cyanamide and synthetic ammonia.	Platinum gauze without electric heating.	About 18,000 tons N.	About 60,000 tons nitric acid.	About 13,000.
(3)	U.S.A.	Ammonia from cyanamide.	Platinum gauze with electric heating.	110,000 tons of ammonium nitrate.	—	—
(4)	U.S.A.	Synthetic ammonia.	Platinum gauze with electric heating.	22,000 tons of ammonium nitrate.	—	—

WORLD'S PRODUCTION OF FIXED NITROGEN.

	Metric tons of nitrogen.			
	1909.	1913.	1917.	1920.*
From natural sources :—				
Chilean nitrate ..	300,000	400,000	400,000	500,000
By-product industry ..	240,000	353,000	400,000	400,000
Total	540,000	753,000	800,000	900,000
From fixation processes :				
Arc and miscellaneous	3,000	18,000	30,000	38,300
Cyanamide	2,500	60,000	200,000	325,000
Synthetic ammonia ..	—	7,000	110,000	308,000
Total	5,500	85,000	340,000	671,300
Grand total ..	545,500	838,000	1,140,000	1,561,300
Proportion of total obtained by fixation processes	1%	10%	30%	43%

* The figures for 1920 are an estimate of the maximum capacity and not of actual production.

POWER USED IN THE NITROGEN FIXATION INDUSTRY.

		Cyanamide process.	Arc process.
Installed capacity, tons of N.	1913	59,500	16,900
do. do.	1920	325,500	38,300
Actual power required, continuous kilowatts	1913	130,000	142,000
do. do.	1920	715,000	316,000

THE CHILEAN NITRATE INDUSTRY DURING THE WAR PERIOD.

Metric tons.

	1917.	1918.	1919.	1920.
Production ..	3,013,517	2,875,902	1,658,350	2,492,000
Exports	2,787,339	2,930,664	918,978	2,757,000
Deliveries for consumption ..	*	*	1,312,000	1,853,000
Visible stocks on June 30	886,043	*	1,490,000	1,170,000

* Figures not available.

PRODUCTION OF SYNTHETIC AMMONIA IN GERMANY.

Metric tons of ammonia per day.

Year.	Oppau.	Merseburg.	Total
1914 ..	25 ..	nil ..	25
1918 ..	220 ..	400 ..	620
1920 .. (estimated max. capacity)	250 ..	800* .. (when complete)	1,050

* Later information leads to the view that this figure for the capacity of the Merseburg works has not yet been attained, and that therefore the estimated maximum capacity for 1920 of the German synthetic ammonia works has not yet reached the figure of 1,050 tous here taken.

Assuming 95 per cent. continuous production, the approximate maximum annual output in terms of metric tons of sulphate was: 1914, 35,000 tons; 1918, 850,000 tons; 1920, 1,500,000 tons.

Prices of Nitrogen Fertilisers in Germany and England.—It is obviously exceedingly difficult to arrive at figures of comparative prices owing to fluctuations in the rate of exchange, to the largely unknown ratio of wages costs to cost of production, etc., but the attempt has been made. In 1920 the German sale price (without tax) at works of nitrogen as ammonium sulphate is estimated to have been 9500 mk. per metric ton, and as cyanamide 9150 mk. per metric ton, compared with 2900 and 1400 mk., respectively, in 1919. The average price per ton of nitrogen as Chilean nitrate in England during 1919 and the first half of 1920 was maintained at about £140, which on the basis of 260 mk. to the £ sterling is much higher than the enhanced German home price. The corresponding British home price of nitrogen as ammonium sulphate was about £100 per ton.

British Developments in Nitrogen Fixation.—Under this head are recorded the plans of Synthetic Ammonia and Nitrates, Ltd. (*cf.* J., 1921, 240 R); the decision of the Cumberland Coal, Power and Chemical Co., Ltd., to use the Claude process, a plant for which is now making 5 t. of ammonia daily in France; the large-scale experimental work of the British Cyanides Co. on the barium process; and the cessation of manufacture of ammonium nitrate from cyanamide by the Nitrogen Products Co. at Dagenham. Canada has one works making cyanamide and one using the arc process; thanks entirely to these the capacity of the Empire in 1920 (fixation processes only) was 1·9 per cent. of the world's total; that of Germany was 63 per cent. or more.

THE PHOSPHATE INDUSTRY.

I.—SOURCES OF SUPPLY OF MINERAL PHOSPHATE.

W. PACKARD.

In pre-war days very little interest was taken in mineral phosphate except by those immediately connected with the trade, but during hostilities the high price of foodstuffs of all kinds greatly encouraged the use of fertilisers, and the labour conditions in all the phosphate-producing areas created a shortage which at one time amounted to almost a world famine. This shortage, which was apparently only temporary and due to difficulties of labour and transport, has created a new interest in phosphate-mining, so that new deposits and rumours of fresh discoveries are to-day matters of world-wide interest. It only needed the British Government to decide on conserving the phosphate resources of the Empire by acquiring the rights of the Pacific Phosphate Company to imbue the public with the idea that phosphate mines and gold mines were equally lucrative propositions; but this has not been the past experience by any means. The Ocean Island deposits, being of very high grade and easily mined by very cheap labour, certainly proved very profitable to the original shareholders, but with this exception phosphate-mining has never been a very lucrative undertaking. Experience has shown that whenever consumption has overtaken production new deposits have been opened up and the shortage very soon turned into a surplus. Even to-day the existing deposits are known to contain enormous reserves in sight, which are capable of supplying the world's demands for a very considerable period.

Phosphates occur in many parts of the world, and vary in quality from a hard, rocky material, such as the Florida hard rock and Curaçao phosphates testing 75—80 per cent. phosphate of lime, to the soft, sandy deposits of North Africa, which contain from 57—65 per cent. of the same constituent. No doubt large quantities of lower-grade mineral occur in different parts of the world, but these are not generally considered workable, except in France and Belgium, where considerable quantities testing 40—50 per cent. are raised annually and are used extensively for direct application to the land. Owing to the varying nature of the deposits the methods of mining differ very widely. Where the phosphate occurs as a rock, as in the Florida hard-rock deposits, blasting is, of course, necessary, whereas in the Florida pebble fields, where the product is in the form of nodules or pebbles often lying close to the surface and in beds from 10 to 20 ft. thick, the overburden is stripped off by means of excavators and the pebble washed out by water pressure. Again, in most of the North African mines the phosphate seams occur in the sides of the hills, and the soft phosphate is dug out in galleries running into the hill and following the face of the seam. In England small deposits of coprolites in the form of hard pebbles were worked some thirty years ago in the Eastern Counties, where the formation is somewhat similar to the Florida pebble beds, but on a very much smaller scale. The coprolites lay in narrow beds at various depths, and where the deposit was close to the surface digging was a simple matter, but these accessible beds were long ago worked out. It may be interesting to note that at the beginning of the war, when the scarcity of phosphates was first being felt, the Admiralty authorities were asked to, and eventually did, supply ships to convey the phosphate from North Africa, but at first they are reported to have pointed out that they could not see their way to do so, as the Geological Survey showed the existence of large deposits of phosphates in England. Whether as a result of this reply or not, the Ministry of Munitions afterwards opened up a coprolite bed and raised some thousands of tons, but the cost proved out of all proportion to the value of the phosphate obtained.

World production of phosphate.

During the ten years immediately preceding the war the demand for phosphates caused a gradual rise in the output, which increased, according to the statistics, from slightly under 5 million tons in 1907 to just over 7 million tons in 1913, in which year the consumption was very little short of the total production.

In 1907, as well as in 1913, the United States showed the largest output, with North Africa second, but it will be noticed from the following statistics that during that period the North African production increased at a greater rate than that of the United States.

	1907 Long Tons	1913 Long Tons
United States	2,301,000	3,161,000
Tunis	1,069,000	2,284,000
Algeria	315,000	461,000
France	375,000	335,000
Belgium	181,000	219,000
Christmas Island	290,000	152,000
Other Pacific Islands	190,000	422,000
Other countries	58,000	195,000
	4,779,000	7,229,000

Of the quantities designated as produced by "other countries," the sources would include Egypt, Japan, Australasia, Curaçao, Russia, etc., of which Egypt contains the most important deposits.

United States.

The first phosphate deposits to be worked in America were the South Carolina deposits, but these are now worked on a very small scale only, and in 1913 Florida and Tennessee produced 96 per cent. of the entire American output. Phosphates are also mined on a small scale in Kentucky and Arkansas, and undeveloped deposits are known to exist in North Carolina, Alabama, Georgia, Virginia, and Idaho.

Florida hard rock.—The deposits of "hard rock" occur very irregularly, and as to location, depth from the surface, extent, quality, and quantity, conform to no general rule; whereas at one point the phosphate may lie at the surface, in other places it may be so deeply buried as to be unworkable. The material above the phosphate is generally of a sandy, clayey nature of variable thickness. In the Florida State Geological Survey Florida hard rock is stated to contain from 79—83 per cent. tricalcium phosphate, but experience of shipments tends to prove that the rock mined contains an average of 77—79 per cent. The hard-rock phosphate was very popular in Europe before the war, no doubt owing to the facts that its high quality makes it economical to transport and that the deposits are all within easy distance of good shipping ports. Also the low percentage of iron and alumina enables a highly soluble superphosphate to be manufactured from it without fear of reversion. In 1913 the output of hard rock amounted to 477,000 tons, all of which was exported, but in 1919 the output was only 341,000 tons, of which 100,000 tons was consumed in America.

Florida land pebble.—The "land-pebble" phosphates are much more easily mined than the hard rock, and are more uniform in their occurrence, although variable from place to place. The phosphate occurs in beds of pebbles in a matrix of clay, sand, and soft phosphate, the overburden consisting of sand and sandy clay. The beds have an average thickness of from 8 to 10 ft., with a maximum of 18 to 20 ft. The highest grades of pebble phosphate contain from 75—76 per cent. tri-calcium phosphate and the lowest grades 62 per cent., being graded for sale as 68—70, 70—72, and 75 per cent. For consumption in America the most popular grade is the 68 per cent., but it is difficult to understand why this should be, as the distances between the mines and the consuming works are often very great. Possibly the farmer may prefer a lower grade and consequently lower-priced superphosphate. In 1913 the output of pebble phosphate was 2,107,000 tons, of which 887,000 tons was exported, but in 1919 the production had fallen to less than 1 million tons, of which only 131,000 tons was exported.

Tennessee phosphate.—The phosphates which occur in Tennessee are of two kinds, known as blue and brown phosphate, respectively. The blue phosphate is a hard, rocky phosphate testing in some cases as high as 85 per cent. phosphate of lime, and the beds are thin, seldom exceeding 20 in. in thickness; the mineral contains a high percentage of iron and alumina, and is not extensively mined. The brown phosphate occurs in irregular deposits close to the surface, resting on limestone with an overburden of clay and sand mixed with phosphate; it is of several kinds, varying from a shelly rock to a mass of small pebbles, and has a reddish-brown colour. The beds average from 8 to 10 ft. in thickness, and the phosphate contains from 70—80 per cent. phosphate of lime, although, of course, there are large deposits of much lower quality. Statistics relating to the production of Tennessee phosphate are somewhat difficult to obtain, but it would appear that in 1913 the quantity mined was about 500,000 tons.

North Africa.

As regards present production, the North African phosphate deposits are second in importance to those of the United States, but it is probable that their extent is far greater than that of any other known deposit. Recent discoveries in Morocco shew that there is an almost continuous series of beds running across the whole of North Africa from Morocco, through Algeria, Tunis, Cyrenaica, to Egypt, but many of these deposits are at present undeveloped, owing chiefly to their distance from the sea and the capital which would have to be spent in developing them. The Algerian deposits were the first to be opened up, but the Tunisian deposits have now been developed to a greater extent, and the Gafsa mines now produce the largest annual tonnage of any single deposit in the world.

Algeria.

The most important deposit in Algeria is at Djbel Kouif, near Tebessa, owned by the Constantine Phosphate Co. The phosphate here occurs in beds varying in thickness from 2 to 9 ft., which lie often one above the other between layers of slate and marl, the slate forming an excellent roof so that galleries can be driven into the hill-side and the phosphate easily extracted. The mineral is soft, and as the phosphate content of the beds varies between 58 to 69 per cent., an average of 64—65 per cent. can easily be maintained. The output from Constantine in 1913 was approximately 300,000 tons, but the production is limited by the capacity of the railway to the nearest port of Bone, which is 120 miles from the mines. The reserves of good-quality phosphate in these mines are enormous. The only other deposit at present worked extensively is the deposit of M'Zaita, where the phosphate occurs in beds of 1 to 6 ft. in thickness, containing from 58 to 63 per cent. phosphate of lime. This phosphate has a dark colour and is of a rocky nature, being much harder than the Constantine quality. The total output from Algeria in 1913 is given as 461,000 tons. Other Algerian deposits are dealt with under the heading Undeveloped Deposits.

Tunis.

The total output of phosphates from Tunis in 1913 is given as 2,284,000 tons, of which over 1 million tons was produced by the mines of the Société des Phosphates de Gafsa, which, as stated above, is the largest production from any single mining company in the world. This company owns the 150 miles of railway between the mines and the port of Sfax, which has an excellent harbour. The phosphate is extremely soft and outcrops in the hills in beds of from 1 to 10 ft. thick, and two qualities are produced, the lower grade testing from 58 to 60 per cent. and the higher grade 60 to 65 per cent. The Société des Phosphates Tunisiens operates the deposits at Kaala Djerda in Tunisia, close to the Algerian deposit of Djbel Kouif. Here the phosphate is again of a soft, sandy nature, containing from 57 to 60 per cent. phosphate of lime. These deposits are of more recent development than those of Gafsa, and are producing about 300,000 tons per annum. The deposits at Maknassy are somewhat similar to those at Kaala Djerda but of slightly higher quality, averaging 60 to 63 per cent. The only other important workings are those of the Société des Phosphates du Dyr, from which a soft phosphate averaging 57 to 59 per cent. is obtained. During the war the North African mines were practically the only source of supply for Europe, as America and the more distant deposits were cut off by shipping difficulties. Labour and transport difficulties, however, reduced the shipments to 820,000 tons in 1919, and the pre-war output has not yet been reached.

Belgium.

There are considerable phosphate deposits still worked in the neighbourhood of Mons and Liége, but the higher grades have been largely worked out and the average grade obtained now is from 40 to 50 per cent. phosphate of lime. The phosphate is soft and sandy, contains a high percentage of carbonate of lime, and is used extensively for application to the land in the ground state as a substitute for basic slag.

France.

There are considerable beds of soft phosphate, known as phosphatic chalk, in the Aisne, Oise, Calais and Somme districts, carrying from 40 to 65 per cent. phosphate of lime. As in the Belgian beds, the higher grades are rapidly being worked out and the output is declining, France now looking to North Africa for her phosphate requirements.

Christmas Island.

Large deposits of phosphate of very high grade occur in Christmas Island in the Indian Ocean, and in 1913, 152,000 tons was exported. These phosphates were formed like those of the Pacific Islands by the combination of organic materials with the calcareous rock, and contain over 80 per cent. tri-calcium phosphate.

Pacific Islands.

The Islands of Nauru, Ocean Island, Angaur, and Makatea exported in 1913 over 400,000 tons of high-grade phosphate containing from 80 to 85 per cent. of tri-calcium phosphate, Ocean Island contributing 189,000 tons. These deposits are similar to those of Christmas Island, the phosphate being soft and lying close to the surface; and if it were not for the relative inaccessibility of the Islands the output would be far greater. They are probably the largest deposits of very high grade phosphate which are known. Nauru is believed to possess reserves of 80 to 100 million tons and Ocean Island 50 million tons. Before the war Nauru and

Angaur belonged to Germany but are now ad-administered by Great Britain and Japan, respectively. A good deal of attention has lately been attracted to Nauru on account of the Government scheme for working the deposits in conjunction with the New Zealand and Australian Governments. Let us hope that this experiment in Government trading may be less expensive than some others have been.

Egypt.

There are extensive phosphate beds in Egypt and in 1913 over 100,000 tons was produced, of which 60,000 tons was exported. In the Sebaia district of the Nile Valley there are large quantities of phosphate lying close to the surface in beds from 18 in. to 6 ft. thick, but the phosphate only averages 45 per cent. phosphate of lime. At Safaga, on the Red Sea, there are considerable deposits running as high as 75 per cent. which are only 18 miles from the sea. There are also large deposits of lower-grade phosphates in this neighbourhood, but they are not worked at present; the mineral outcrops in the hillside and, being soft, is easily worked. There are also extensive deposits lower down the Red Sea near Kosseir which are being developed, and there is no doubt that a very large quantity of phosphate is available in this region.

Undeveloped deposits.

If any doubts existed concerning a sufficiency of phosphate for the world's requirements for many years to come, they should have disappeared after the important discoveries made during the war. The most promising of these is in Morocco where development has already commenced and sample shipments are early expected. These deposits are situated at El-Beroudj, about 80 miles south-east of Casablanca, and are said to contain hundreds of millions of tons of phosphate. The beds occur in the Beni Meshine Plateau beneath limestone and vary in thickness from 4 to 6 ft. Some of the phosphate is believed to contain as much as 75 per cent. calcium phosphate, and if the bulk proves to be as rich as this, the deposit will be a very valuable one for European requirements.

Large deposits of phosphates were prospected in Palestine during the year 1916 by a German professor, who reported that the discoveries were very important, and the fact that a military railway has been since constructed running very close to the deposit may have an important bearing on its development. At one point borings showed a deposit of great thickness, approximately 65 ft., with an average test of 72 per cent. and in places 83 per cent. phosphate of lime. There appear to be many deposits in Palestine of an unusual thickness varying in phosphate content from 62 to 83 per cent., and, if reports be correct, it should not be long before these beds are developed on a large scale.

Another large deposit which has not yet been developed is known to exist at Djebel Onk in Algeria, 50 miles south of Tebessa. This deposit would be dependent on the Tebessa-Bone railway, which appears to be only capable of dealing with the present traffic, but it is reported that an extension is contemplated to Djebel Onk. These deposits are estimated to contain at least one thousand million tons of phosphate averaging 60—70 per cent., and must be looked upon as very important.

It has been impossible in the space available to deal with every known phosphatic deposit in detail, but all the more important have been referred to in an attempt to show the magnitude of the industry which has arisen from Lawes' first experiments in dissolving coprolites.

SOCIETY OF CHEMICAL INDUSTRY.

MEETING OF COUNCIL.

A short meeting of the Council was held on August 5 to transact certain routine business prior to the departure of the President for Canada. Sir William Pope stated that he had received a letter from Monsieur P. Kestner intimating that the Annual Meeting of the Société de Chimie Industrielle will be held in Paris from October 9 to 12, and asking that the Society would send a number of delegates; a few members of Council had already undertaken to attend the meeting, and he hoped that others would send in their names.

NEWS FROM THE SECTIONS.

OTTAWA.

The annual meeting was held on April 14, with Mr. F. J. Hambly in the chair. The hon. secretary, Mr. S. J. Cook, read his report which intimated, *inter alia*, that Mr. E. Stansfield, the chairman of the Section, had severed his connexion with the Department of Mines, in which he was chief engineering chemist of the Fuel-Testing Division, and had gone to the University of Alberta to take up some special research work on the utilisation of the lignite-coals in that province.

During the past session the Section has held 6 meetings (exclusive of the annual meeting), at which the average attendance was 44—an improvement upon the previous year. At the opening meeting, Mr. H. H. Claudet, manager of the General Engineering Co., gave an address on "Mineral Flotation Processes." The meeting in December was devoted to an address by Mr. R. T. Elworthy on "The History and Manufacture of Helium." At the third meeting a kinematograph film portraying the Story of Coal was shown; at the fourth, Mr. P. L. Peek described the operations of the British America Nickel plant at Deschenes, and subsequently the members visited the plant and made a thorough inspection. The subject of "Vitamins" was discussed at the January meeting, "Cements and Super-cements" at the February meeting, and at the last meeting Mr. F. E. Lathe, chief chemist to the British America Nickel Corporation, gave a lecture on "Principles underlying Copper-Leaching and Precipitation."

During the past session the Section enrolled 17 new members and 30 Associates, which compares with 15 members and 32 Associates in the year 1919–20. The most important event of the year was the dissolution of the Canadian Section of the Society and the establishment of five independent Sections, of which Ottawa is one.

Taken in review, states the report, the past year may be considered successful, although it may be open to question whether in future it will be desirable to hold so many joint meetings with other societies as were held this session. The tendency, when this is done, is for some of the members of the Society to consider themselves relieved, as it were, of their responsibilities. It seems desirable, therefore, to suggest that the incoming Committee should seek to strengthen the position of the Section, and, in view of the visit of the parent Society to Canada this year, it will probably be found essential for every member in Canada to exert himself in the interests of the Society in order that the desired results may be attained.

Mr. F. J. Hambly was elected chairman of the Section for the ensuing year, Mr. S. J. Cook was re-elected hon. secretary, and as the result of a ballot the following were elected to serve upon the committee:—Dr. A. E. Macintyre and Mr. A. E. MacRae (re-elected); Col. J. T. Janson, Mr. R. T. Elworthy, and Dr. A. Tingle. While the votes were being counted, kinematograph displays were given representing the manufacture of sulphuric acid, loaned by the General Chemical Co., of New York, and the pulp and paper plant of the Riordon Co. at Kippawa.

On June 30 the Ottawa Section acted as host to the members of the American Institute of Chemical Engineers who visited Ottawa on that date. The visitors were entertained at luncheon at the Chateau Laurier, and 200 members and guests were present. Short addresses were given by the Rt. Hon. Sir George E. Foster, on behalf of the Dominion Government; Major Harold Fisher, representing the City of Ottawa; Mr. John Bigelow, President of the Ottawa Board of Trade; Mr. Charles Camsel, Deputy Minister, Department of Mines; and Mr. David Wesson, President of the American Institute of Chemical Engineers. After luncheon, by courtesy of the Hull Electric Co., the party was taken to inspect the plant of the E. B. Eddy Co. in Hull, and also that operated by J. R. Booth.

MEETINGS OF OTHER SOCIETIES.

THE INTERNATIONAL COMMISSION ON ILLUMINATION.

The first technical session of this Commission, the successor of the International Photometric Commission, was held in Paris from July 4 to 8 in the rooms of the Société du Gaz. Those interested in illumination problems in Belgium, France, Great Britain, Italy, Spain, Switzerland, and the United States of America were represented at the session, which was opened by the Minister of Public Works, who welcomed the delegates in the name of the French Republic. The British delegates, nominated by the National Illumination Committee of Great Britain, were:—Major K. Edgcumbe (Institution of Electrical Engineers, Chairman of the National Committee); Mr. C. C. Paterson (Hon. Secretary and Treasurer of the International Commission); Mr. A. P. Trotter (Illuminating Engineering Society); Dr. E. H. Rayner (National Physical Laboratory); Mr. L. Gaster (Illuminating Engineering Society); Mr. R. Watson (Institution of Gas Engineers); and Mr. J. W. T. Walsh (National Physical Laboratory; Assistant Secretary of the International Commission. The subjects dealt with by the Commission were as follows:—

(1) The unit of candle-power at present in use in this country and in France and U.S.A. was adopted for international purposes and is to be known as the "international candle." It is maintained by means of electric incandescent lamps at the national laboratories of the three countries named.

(2) The definitions of the terms "luminous flux," "luminous intensity," and "illumination," and the units of these quantities, viz., the lumen, the candle, and the lux (metre-candle) were agreed to.

(3) The subjects of heterochromatic photometry (including physical photometry, and the characteristics of the "normal eye"), factory lighting, and automobile head-lighting, were also discussed at the meetings, and sub-committees were appointed to study the questions from the international standpoint during the next three years.

The new president of the Commission is Dr. E. P. Hyde, Director of the Nela Research Laboratories of America; Major Edgcumbe is one of the three vice-presidents. The next meeting of the Commission was provisionally arranged to take place in New York in 1924.

PERSONALIA.

The John Fritz medal of the American Engineering Foundation for 1922 has been awarded to M. E. Schneider, the head of the Creusot Co.

Dr. D. Segaller, head of the technical department of the British Dyestuffs Corporation, Ltd. (Huddersfield), is severing his connexion with the Corporation.

M. Tourneux, "maître de conférences" in physical chemistry at the University of Montpellier, has been appointed professor of chemistry in the University of Besançon, in succession to the late M. Boutroux.

Dr. Danckwortt, professor of pharmaceutical chemistry in the University of Greifswald, has been appointed professor of chemistry and director of the Chemical Institute in the Veterinary "Hochschule" in Hannover.

Prof. W. Nernst has been appointed Rector of Berlin University, and Prof. J. Gadamer, who succeeded the late Prof. E. Schmidt in the chair of pharmaceutical chemistry at Marburg, has been elected Rector of Marburg University.

The death is announced of Mr. E. B. Biggar, who in 1917 founded the *Canadian Chemical Journal*, now known as *Canadian Chemistry and Metallurgy*.

CORRESPONDENCE.

AMERICAN METHODS OF BACTERIOLOGICAL WATER CONTROL.

Sir,—In the issue of the *Journal of the Society of Chemical Industry* for April 30, 1921 (p. 159 R) there appears a review on a book written by Milton F. Stein on water purification plants and their operation. The following part of the review is noted particularly:—

> "The Americans seem to be content with a standard based on percentage reduction, whilst in this country an absolute standard is generally insisted upon. Thus, if the raw water contained, say, *B. coli* in 0·001 c.c., and in the finally purified effluent this was reduced to a positive result with 1 c.c., they would call this a 99·9 per cent. reduction and be satisfied with it, but in this country we are not completely satisfied with sending water into consumption even with *B. coli* in 100 c.c."

To prevent any incorrect impressions which your readers may obtain from this review, it is desired to state that the most widely-used standard of purity for domestic water supplies in the United States is the Treasury Department Standard as noted on the inclosure.* Although it is the practice in American waterworks plants to determine the percentage reduction in bacteria in water treated by the plants, such information is used to note the effective operation of the plant and not as a standard of purity for domestic water supplies.

In general, water supplies in the United States are not considered of satisfactory sanitary quality and safety for domestic use until complete information from adequate sanitary surveys and laboratory analyses shows freedom from danger of pollution.

It would be appreciated if the foregoing information were furnished your readers.—I am, Sir, etc.,

H. S. Cumming (Surgeon-General).

Bureau of the Public Health Service,
Washington, U.S.A., July 11, 1921.

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* Form of Certificate of Examination of Water provided by Persons, Firms, or Corporations engaged in Interstate Traffic (No. 8921).

NEWS AND NOTES.

SOUTH AFRICA.

The First Paper Mill.—The completion of the trial run of the Premier Paper Mills at Klip River, Germiston, near Johannesburg, marks the inception of paper manufacture in the Union of S. Africa. At present the production is confined to wrapping paper, but it is intended to manufacture other grades of paper as the position of the enterprise becomes consolidated.—(*S. Afr. J. Ind., June,* 1921.)

Prospects for an Iron and Steel Industry.—In the *South African Journal of Industries* (June, 1921), Mr. E. Bury sums up his impressions of the Union's resources for the establishment of a national iron and steel industry. At the present time scrap iron and steel from imported manufactures are melted and used in the country instead of being sent to Europe as formerly, and there is a small plant at Pretoria making 10 tons a day of pig iron which has demonstrated the practicability of producing saleable iron of all grades from South African minerals. It may now be taken as proved that the Union possesses enormous deposits of iron ore, all of which could be utilised except the titaniferous magnetite; extensive reserves of coking coal in the Middelburg district; huge deposits of dolomite adjacent to the iron-ore, and limestone proper. The small plant at Pretoria has produced thousands of tons of excellent foundry iron which have found a ready sale, heavy castings, including a mine winding-engine, motive parts of machinery of all kinds, and excellent steel-making iron, low in sulphur. The cost of production of the iron has not exceeded the present cost of bulk-production in England. The coke produced from certain Witbank coals was found to be well-suited for blast-furnace use; the samples examined by Mr. Bury were high in phosphorus but of no detriment in the basic open-hearth process, which will have to be the standard method for steel manufacture in the Union. The South African Iron and Steel Corporation has acquired sufficient mineral reserves to cover the demands of a works of 150,000 t. annual capacity for at least 100 years. Ample coal reserves are owned by the Corporation, which intends to treat and utilise "smalls" for the manufacture of iron and steel and to market its surplus. It also proposes to recover the whole of the by-products from coke-making incidental to the manufacture of pig iron, and to utilise the waste gases for converting pig iron into finished steel; and among these by-products will be fuel oil and materials for the manufacture of dyes, high explosives, drugs, fertilisers, disinfectants and cattle dips. In the author's opinion the case for founding a national and self-contained iron and steel industry has been established.

CANADA.

Reported Mineral Discoveries.—It is announced that a discovery of gold has been made at Elbow Lake, Northern Manitoba, in porphyry carrying stringers of quartz in which gold may be seen over a width of 50 ft. The high-grade material is 3 in. deep and extends 350 ft. along the strike, but the intervening part of the lode is covered with clay.

A large body of strontium sulphate and strontium carbonate (celestine and strontianite), covering an area of 50 acres, is reported to have been found at Tidewater, 200 miles north of Vancouver, B.C. The discovery is of interest in view of the use of strontium hydrate in refining sugar and the possibility that strontium sulphate may replace barium sulphate in paint manufacture.—(*Can. Chem. and Met., July,* 1921.)

The Ink Industry in 1918.—Of the fourteen plants engaged in the production of inks and related products in Canada in 1918, 9 were in Ontario, 2 in Quebec, 2 in British Columbia, and 1 in Manitoba. With a total invested capital of $1,022,089, the production of the plants was valued at $1,746,935 at the works. The output included printing inks worth $1,121,457 and writing inks worth $141,261, and the materials used cost $876,672. Imports of inks and allied products were valued at $552,408.

UNITED STATES.

The American Ceramic Society.—The twenty-fourth annual meeting of this Society will be held in St. Louis from February 27 to March 2, 1922. St. Louis is one of the largest centres in the States for refractories and heavy clay products, and enamelled ware, glass, and terra cotta are also manufactured there.

A New Borax Deposit.—A deposit of pure colemanite has recently been discovered in Clark County, Neveda, and has been acquired by a Californian company. The deposit is in the form of a hill measuring about 3000 ft. long and 300—500 ft. high, and is estimated to contain more than 500,000 tons of mineral, which is easily mined. The locality is already served by a railway.

Chemical Industry and the Department of Commerce.—At the instigation of Mr. H. C. Hoover, Secretary of Commerce, a conference of representatives of the chemical and allied industries has been called to consider how the Government could aid in the standardisation of chemicals and apparatus; and chemical manufacturers have been invited to attend conferences to discuss how the statistical work of the Department of Commerce might be made of greater utility to them. This Department has asked Congress for supplementary appropriations of over $618,000 to establish twelve new divisions of the Bureau of Foreign and Domestic Commerce, one of which would be for the chemical and dyestuff industry. Out of an additional $250,000 wanted for the Bureau of Standards, $100,000 would be allocated to furthering the commercial utilisation of industrial wastes and by-products.

The Dyestuff Industry.—Dr. Edgar F. Smith, president of the American Chemical Society, has addressed a letter to the chairman of the Ways and Means Committee of the House of Representatives urging the importance of passing legislation to facilitate the establishment of an independent coal-tar chemical industry, and combating the view that there is an American dye monopoly. In this letter he enumerates some interesting facts which have been disclosed in the Census of Dyes and Coal-tar Chemicals for 1920, recently published by the U.S. Tariff Commission.

The production of dyes in 1920 was over 39,000 long tons, or 40 per cent. greater than in 1919 and 92 per cent. above the pre-war figures. In 1914 there were seven plants making coal-tar dyes mostly from German materials. To-day there are 213 firms producing coal-tar products and 82 making dyes alone. Of the 360 different dyes manufactured in 1920, 108, representing over 90 per cent. of the production, were made by three or more firms, and 35, representing one-half of the total, were made by seven or more firms. The number of by-product coke ovens, which increased by 700 during the year, is now over 10,000; the output of coal tar from all sources is sufficient to meet the demands of the coal-tar chemical industry; and it is anticipated that the production of anthracene and anthraquinone will soon suffice for all requirements.

The new Tariff Bill, now before the House of Representatives, provides that the importation of certain dyes and chemicals should be prohibited so long as the Commission is satisfied that they are unobtainable in the country on reasonable terms as to quality, price, and delivery, a reasonable price meaning the lowest to maintain domestic manufacture by an efficient plant working on an industrial scale. Importers of coal-tar products will have to give a bond of not less than $10,000 for compliance with the law and regulations, and certify that each shipment is for their own use and does not exceed six months' supply, or that it is imported to meet the order of a wholesaler or retailer, who must guarantee its distribution. The Bill also contains provisions to prevent unfair competition (*cf.* p. 300 of this issue).

FRANCE.

Phosphate Production in Algeria.—The quantity of phosphate rock produced in Algeria in 1920 was 502,931 metric tons, and the amount exported 351,221 t. During the first quarter of 1921 the production was 131,106 t. and the export 82,595 t., as against 88,826 t. and 44,335 t., respectively, in the corresponding period of 1920.—(*U.S. Com. Rep., June* 27, 1921.)

Gonakie Bark as a Tanning Material.—Experiments made in French West Africa with the bark of the gonakie tree as a tanning material have given encouraging results, and the *Bulletin de l'Agence Générale des Colonies* claims that this bark will eventually supersede quebracho as a tanning material in Europe. The tree grows in abundance along the northern tributaries of the Niger River and throughout French West Guinea, and the bark can be easily harvested. French tanneries that have used the bark are said to have obtained good results with it.—(*U.S. Com. Rep., June* 1, 1921.)

The Concentration of Apple Juice.—Owing to the transport crises, the stoppage of distillation, and the lack of storage facilities, a large part of last season's apple crop was lost, but if apparatus for concentrating the juice had been available, much of the crop could have been stored in a very small space. These remarks are made by M. Warcollier, director of the Pomological Station at Caen, in a report concerning tests carried out by him on the concentration of apple juice in a factory at St. Sever (Calvados). The tests were performed on samples of weak and concentrated juice at 35° and 36° Bé., and the apparatus used was an evaporator of the "climbing and falling film" type. The results, which refer to 1 litre of juice, were as follows:—

	A. Juice from the press.	A. after conc. under 35 c.m. pressure.	A. after conc. at atm. pr.	B. Defecated & sulphited juice with 40 g. SO_2 per hectol.	B. after conc. under 35 c.m. pressure.	B. after conc. at atm. pr.
Density	1·045	1·3316	1·2906	1·048	1·3428	1·2942
Deg. Bé	6°	35·9°	32·4°	6·6°	36·7°	32·7°
Saccharose	8·4	61·5	52·5	8·4	64·2	54·5
Dextrose	18·7	143·0	119·5	20·8	158·5	136·5
Levulose	66·9	503·9	432·5	67·9	521·0	439·5
Total dry extract at 100° ..	115·2	857·2	738·4	120·1	905·4	779·6
Total acidity (H_2SO_4) ..	2·2	12·5	10·7	21	12·9	10·7
SO_2, free	nil	nil	nil	0·025 g.	nil	nil
SO_2, combined	nil	nil	nil	0·487 g.	0·280 g.	0·270 g.
SO_2, total	nil	nil	nil	0·512 g.	0·280 g.	0·270 g.

The results showed that de-sulphiting was complete, and that the nature of the juice was not altered by concentration under atmospheric pressure, A delicate palate can distinguish a slight difference between the juices concentrated under reduced pressure and under atmospheric pressure, but this difference disappears completely when the concentrated juice is diluted with water or with cider. By using a continuous evaporator of the type mentioned, concentration is very rapid and can be carried out at a relatively high temperature; hence there is no need to use a vacuum pump or an extraction pump.

Industrial Notes.—*Physico-chemical Research.*—It is no longer a secret that financial difficulties are handicapping scientific research in France; lack of funds is curtailing investigation in the principal institutes, schools and colleges, and the great laboratories are becoming depleted of investigators. The gift of 10 million francs by M. Ed. de Rothschild for the assistance of young research workers therefore comes at a very opportune time. The fund will be devoted to physico-chemical research, and will be under the control of a council of 25 members representing the chief scientific institutions in the country. M. Rothschild will sit on the council, and provision is made that a member of his family shall always be directly associated with the scheme. There will, in addition, be an administrative committee of five or six persons appointed by the council to adjudicate on the question of grants, for which 600,000 fr. will be available yearly. No subsidies will be given to State institutions, and the only recipients will be investigators engaged in physical and chemical research who are not in receipt of financial assistance from any other outside source.

The Chemical Market.—At the end of July this market was fairly steady, but with very little business doing. There was some demand for hydrochloric and sulphuric acids, but nitric acid was not wanted, and prices remained unchanged. The demand for ammonia was slack, but as stocks are now low, any revival of activity will be immediately reflected in the price.

The Metallurgical Market.—Bad financial conditions, curtailment of orders by the railway companies and the building trade, and foreign competition, all combine to perpetuate the present slump. Prices of non-ferrous metals have become more stable, and those of ferrous metals will follow when production costs have been reduced; that such reduction is possible may be inferred from the fact that the price of coke in France is 110 fr. per metric ton, against 60—65 fr. per ton in Germany. The average price of heavy metallurgical products in France is about 2½ times the pre-war price; that of pig iron is about 225 fr. per ton, hæmatite iron 425 fr., and steel rails 550 fr. The price of coal in Germany is about one-half of that in France, and the cost of labour only one-third.

Resources of Upper Senegal-Niger.—The French colony of Upper Senegal-Niger offers many possibilities for the cultivation of industrial crops, but hitherto little has been done. In 1914, however, the French Government lent its support to a scheme for irrigating a maximum of 247,000 acres of cotton land in the Niger basin, and a company was formed to carry it out. Other fibre crops that offer promise are dâ, jute, sisal, and kapok. Dâ is already cultivated extensively by the natives; the dried stems yield 18—20 per cent. of fibre, used for sack-making, ropes, etc., and 36—38 per cent. of cellulose suitable for paper-manufacture. The fibre can be classed with bamboo, jute and even alfa as regards felting power, and for every metric ton produced, 700—

1000 kg. of seeds is obtained, yielding 17—20 per cent. of edible oil and a residual cake suitable for stock feeding. The cultivation of sisal is localised in the Kayes region, where it covers several thousand acres. At present only a few dozen tons of kapok are exported annually, but the production could easily be increased; the seeds furnish an industrial oil. In addition to inferior gums, the colony produces best-quality gum arabic. This is obtained from *Acacia verek* to the annual amount of about 3000 t., *i.e.*, 60 per cent. of the entire French consumption. Other products are rubber, an acacia of which the pod is used in tanning, piassava, and various tinctorial and oil-bearing plants.—(*Rev. Prod. Chim., May* 15, 1921.)

GENERAL.

Determination of the Finer Dust Particles in Air.—Dr. A. L. Meyer, of Johns Hopkins University, has devised a method for determining the finer dust particles in the air which is based on the principle that water when brought into intimate contact with air removes the insoluble particles that are in suspension. Dr. Meyer employs a graduated syringe which enables him to measure the quantities of air and water used and in which thorough contact is effected by shaking the two phases. The number of particles taken up by water is estimated microscopically with the aid of oblique illumination and Levy's blood-counter. The average deviation of the number of particles per c.c. of air containing 20,000—80,000 particles obtained by this method was not more than ±4000 for 100 c.c. and ±2000 for 200 c.c. samples. The method is specially suitable for the determination of smoke particles in the atmosphere and for testing the efficiency of air-filtering devices in various ventilation schemes. As a comparison is not made with figures obtained by other methods, it is impossible to assess the accuracy of the method, which has also the drawback of not estimating the water-soluble particles.—(*J. Ind. Hyg., June*, 1921.)

The Belgian Zinc Industry.—Considerable improvement took place in the Belgian zinc industry in 1920, the total output amounting to 82,960 tons, as compared with 19,860 t. in 1919 and 204,220 t. in 1913. At the close of the year, however, the market became so inactive that production was curtailed, and the output fell from 8310 t. in January, 1921, to 4320 t. in April, 1921. Production is said to be unprofitable with the present prices of coal and labour. The Mines et Fonderies de Zinc de la Vieille Montagne, the largest zinc company in Europe, produced 19,080 t. raw zinc and 70,000 t. finished zinc products during 1920, as against a pre-war average of 130,000 t. of finished products per annum. Although this company produced only 10,000 t. of sulphuric acid (100,000 t. in 1913), the production of this acid throughout Belgium was satisfactory. The Société Métallurgique de Corphalie, at Huy, produced 3772 t. of crude zinc in the fiscal year 1919-20, and the Société de la Nouvelle Montagne 5930 t. of crude zinc, 4438 t. of rolled zinc, and 19,223 t. of sulphuric acid. Lithopone is made by two companies only, the Société Anonyme des Produits Chimiques de Wilsele, near Louvain, and the Société Anonyme Stella, at Haren, near Brussels. Their joint annual production is 16,000 t. The output of other zinc products is still much below the pre-war average; thus the production of zinc oxide and zinc chloride in 1920 was 1500 t. and 150 t., compared with 9118 t. and 300 t., respectively, in 1913.—(*U.S. Com. Rep., July* 2, 1921.)

Leather Research in Germany.—It has been definitely decided that the new Research Institute for the Leather Industry shall be located in Dresden. The industry itself is contributing 8,659,000 mk. towards the cost, and about 3 million mk. is being given by the Export Bureau for the Leather Industry. The State of Saxony is contributing 1 million mk., and the city of Dresden will give a yearly subsidy of 150,000 mk. and provide the necessary building. Prof. E. Stiasny will probably be the first director of the Institute.—(*Chem.-Z., July* 26, 1921.)

The German Dye Industry.—The German dye industry has suffered an extraordinarily severe setback during the first half of 1921, and the future is regarded with anxiety owing to the difficulty of selling in foreign markets on account of the heavy import duties placed on colours in so many countries. About 80 per cent. of the German coal-tar dye industry, which exported some 20,000 tons of dyes in 1920, as compared with 64,285 t. in 1913, lies in the occupied region, and was therefore severely affected by the "sanctions." The special export tax imposed on synthetic dyes on April 8 by the Rhineland Commission has now been suspended, but too late to prevent serious damage to the export trade. The dye industry has also suffered from the fact that some of the Allied countries have placed their share of the Reparation dyes on the open market. According to Dr. Duisberg, the consumption of dyes has now ceased in Russia and the region round Lodz, which prior to the war imported large quantities of dyes. Moreover, England and America have practically prohibited the importation of German dyes, in Italy great competition has developed, and in France many of the national explosives factories have been partially converted for dye manufacture. Dr. Steinkrüger, dealing with the German mineral colour industry, describes the position towards the end of 1920 as a "buyers' strike," and states that the works were compelled to manufacture solely for stock in order to avoid discharging workmen, and that since the establishment of the Rhine customs on May 10 the import and export trades have ceased entirely. The internal consumption of ceramic colours in Germany has decreased owing to the present small requirements of the porcelain industry, and the German consumption of printing colours has also declined largely owing to the restrictions in printing catalogues, advertisements, etc., enforced by the economic position.

Chemical Industry in Poland.—The development of Polish chemical industry has been retarded owing to difficulties in importing raw materials, but restrictions have now been removed and large quantities of fats, resins, coal-tar dyes, and fertilisers are being imported. Hence soda, lubricants, boot polish, mineral colours, and soaps are now being manufactured in sufficient quantities to render further importation unnecessary. Prior to the war there were 112 chemical works in Congress Poland, of which only 68 have survived, but 21 new works have been established during the last two years. Most of the imported materials came from Germany and the chief home manufactures included gas, mineral acids, superphosphate, products made from leather-waste, synthetic dyes, tannins, pharmaceutical requisites, soda, and various salts. At the present time many Polish works are making fertilisers and explosives; and the erection of new factories is contemplated.—(*Chem. Ind., May* 30, 1921.)

Industrial Notes from Mexico.—*Petroleum.*—According to geologists' reports the oilfields of the Bravos, Iturbide, Camargo, and Ojinaga districts contain considerable quantities of oil and are attracting more attention. Large numbers of permits for drilling in the Isthmus district have lately been applied for, but no permits for the exploration or exploitation of petroleum lands in Mexico will be issued until the final disposition of Article 27 of the Constitution has been decided.

Ixtle Fibre.—There has recently been a revived demand for this fibre, which is similar to sisal, but of lower grade, and is produced in the northern States of Mexico. Ordinary ixtle is used for making inferior cordage and for matting, etc.; the "tula" or root ixtle (also known as "tampico") is used for making stiff brushes. The price of ixtle is usually about 1 cent per lb. less than that of sisal.—(*U.S. Com. Rep., May* 12,1921.)

The Java Sugar Crop in 1920.—The total production of sugar in Java in recent years has been as follows: 1918, 1,799,500 tons; 1919, 1,264,800 t.; 1920, 1,509,200 t.; the estimate for 1921 is 1,575,000 t. Most of the 1920 crop was sold early in the year at high prices, and the subsequent enormous rise in the world's markets enabled producers to sell their crops at great profits. Exports in the years 1918, 1919 and 1920 were 1,339,383 t., 1,198,389 t., and 1,051,708 t., and roughly 62,684 t. of the 1921 crop has already been disposed of. The chief markets in 1920 were in order of importance, British India, United States, Hongkong, and Japan.—(*Bd. of Trade J., May* 5, 1921.)

Manchuria in 1919.—Although Manchuria is rich in minerals such as coal, iron, gold, lead, silver, and asbestos, only three mines were worked during 1919. The Fushun coal-mine is operated by the South Manchuria Railway, and produced roughly 7000 tons per day; the Fenhsihu coal-mine is operated by a Japanese-Chinese syndicate and has a daily output of 1000 tons of coal and 260 tons of iron; and the mine at Yontai produces about 100,000 tons of coal per annum. There are valuable coal deposits throughout Manchuria, but the control of transport by the Japanese makes it practically impossible for Chinese to operate any of the smaller mines near the Japanese railways. In consequence efforts are being made to develop mines situated along the Peking-Mukden line of the Chinese Government railway. There is a rich iron-ore deposit at Anshanchan, worked by the South Manchuria Railway, and when the mine is fully developed an output of 1 million t. of pig iron per annum is anticipated. Gold is found very widely in northern Manchuria, but has not been mined to any extent, and alluvial gold is found along the banks of the River Amur. Soya beans and their products form about 75 per cent. of the value of the exports; the annual production is about 100 million bushels, and 120,000 t. of soya-bean oil and 1 million t. of beans and bean-cake are exported. The sugar-beet is little cultivated as yet, but it is well adapted to the country and has a promising future. Manchuria is primarily an agricultural country but there are excellent prospects for the development of manufacturing industries owing to the abundance of coal, raw materials and labour. Industries that are already established include soya-bean products, glass, paper, matches, sugar, brewing and tanning. The fact that the imports of foreign goods in 1919 were valued at $202,676,923 shows that Manchuria offers a wide field for foreign trade.—(*U.S. Com. Rep., No.* 55*g*., 1920.)

GOVERNMENT ORDERS AND NOTICES.

Liquid-Air or Oxygen Explosives.—By an Order in Council of July 14, the manufacture of an explosive consisting of an absorbent carbonaceous material impregnated with liquid air or oxygen is exempted from such of the provisions of the Explosives Act as relate to the manufacture of an explosive, provided that no person shall manufacture the explosive unless he has obtained a licence from the Secretary of State authorising him to do so and complies with any conditions attached to the licence.

PARLIAMENTARY NEWS.

HOUSE OF COMMONS.

German Potash Contract.

In reply to Sir R. Cooper, Sir W. Mitchell-Thomson said that the German potash contract had been concluded, and had yielded a net profit of £28,700, which, however, had not yet been paid to the Treasury. Steps were being taken to collect a balance owing by the agents who distributed the potash on behalf of the Board of Trade.—(July 25.)

Australian Zinc Concentrates.

Sir W. Mitchell-Thomson, answering Lieut.-Com. Kenworthy, said that the sums expended on the purchase of Australian zinc concentrates during the three years ending March 31, 1919, 1920, and 1921, were £1,221,859, £490,137, and £151,951, respectively, and 4972 tons of concentrates had been sold at an average price of £7 17s. per ton c.i.f. He had no reason to think that the Australian purchase contract had contributed materially to the suspension of zinc mining in Great Britain, as the British mineowners could not produce save at prices quite out of proportion to the market price of spelter. At present the spelter industry throughout the world was extremely depressed and there was practically no market for ores.

No inquiries had been received for the purchase of these concentrates at acceptable prices, but it was hoped to sell in Australia for smelting there. All the concentrates so far delivered had been paid for, and there were no liabilities at the moment, but the contract was a continuing one, and he could not say what the future production and liability might be.—(July 25, Aug. 2.)

Holton Heath Cordite Factory.

Replying to Mr. Waddington and Lieut.-Col. Hurst, Commander Eyres-Monsell said that all the processes connected with the manufacture of cordite were now carried on at Holton Heath factory except that of bleaching the cotton, a plant for which was being erected by the Admiralty. The bleaching could be carried out equally well in Lancashire, but this was not desirable as it would entail the employment of another staff and special measures to avoid contamination with dirt during transit. Any impurity in the cotton might cause corrosion and eventual spontaneous combustion, a danger which had to be provided against. Now, however, the final purification would take place immediately before nitration, so that the cotton would not be handled in transit subsequent to cleansing.—(July 20, 27.)

Date of Termination of the War.

The Prime Minister informed Mr. A. Parkinson that the official date of the termination of the war, except as regarded Turkey, would be September 1 next.—(July 28.)

Report on the Alkali Industry.

In a written answer to Mr. Myers, Mr. Baldwin said that it had been decided not to publish the report on the alkali industry prepared by the Sub-committee of the Standing Committee on Trusts as, owing to the expiry of the Profiteering Act on May 19, the Sub-committee was unable to conduct an exhaustive investigation; it was not desirable to publish an incomplete report.—(Aug. 1.)

Indian Monazite Sand.

Answering Sir J. D. Rees, Mr. Montagu said that no foregn-owned company controlled the sale of monazite sand in Travancore State or elsewhere in India.—(Aug. 2.)

LEGAL INTELLIGENCE.

Liability for Damages due to an Explosion. *Belvedere Fish Guano Co., Ltd. v. Rainham Chemical Works, Ltd., and Others.*

On July 28 the House of Lords heard the appeal of the Rainham Chemical Works, Ltd. (in liquidation) and Messrs. S. J. Feldman and R. J. Partridge in the action brought against them by the Belvedere Fish Guano Co., Ltd., for £10,547 damages. The claim arose out of an explosion at the chemical works, in September, 1916, where picric acid was being manufactured from dinitrophenol, the adjacent property of the respondents being damaged. Lord Justice Scrutton held that the Rainham Chemical Works, Ltd., and Messrs. Feldman and Partridge were liable and the Court of Appeal held that the latter were personally responsible (*cf.* J., 1919, 294 R; 1920, 118 R).

Lord Buckmaster now submitted that Messrs. Feldman and Partridge had never divested themselves of occupation of the property so as to substitute the occupation of the company in place of their own. Lords Sumner, Parmoor, Wrenbury, and Carson concurred, and the appeal was dismissed.

Pre-war German Dye Contracts. *In re the Badische Co., Ltd., the Bayer Co., Ltd., the Griesheim Elektron, Ltd., the Kalle Co., Ltd., the Berlin Aniline Co., Ltd., and Meister Lucius and Brüning, Ltd.*

In the Chancery Court, on July 28, Mr. Justice Russell delivered judgment on a series of summonses taken out by the controllers of the above companies, which were registered in this country but wound up under the Trading with the Enemy Acts, to obtain directions of the Court as to whether they should deal with claims amounting to several millions sterling made by certain British firms for breach of contract. The British firms, viz., the Calico Printers' Association, the Bradford Dyers' Association, the Indigo Buying Amalgamation, and the British Cotton and Wool-Dyers, claimed damages for the non-delivery of dyes ordered before the war because (1) they treated with the companies exclusively as principals and not as agents, and (2) that if the contracts were merely suspended for the period of the war, as the controllers contended, there had been an anticipatory breach by reason of the winding-up proceedings.

His Lordship dealt with the contracts in two groups, viz., indigo, and colours other than indigo. Taking first the contracts with the Bayer Co., he said that the German Bayer company held the majority of the shares of the English company and was vitally interested in the English business. Having regard to the English company's history and its bearing on the House of Lord's judgment in the case of the Continental Tyre and Rubber Co. v. the Daimler Co., he held that at the outbreak of war the company assumed an enemy character and its contracts were consequently dissolved. The claims for damages must therefore be rejected. The veil behind which the German manufacturers pulled the strings which manipulated the English figures was less transparent in this case than in that of the other five German companies, and therefore the controllers of these companies also succeeded.

The indigo contracts were different, inasmuch as at the date of the contracts synthetic indigo was being made at the works of Meister Lucius and Brüning at Ellesmere Port under patents transferred by the German firm of the same name, but the phenylglycine required in its manufacture came solely from Germany. The contracts in the indigo group were for the supply of an article which could not be made unless the essentials were imported from Germany, and therefore the legal position of Meister Lucius and Brüning did not differ from that of the other companies. The claims for damages therefore failed for the same reasons.

His Lordship directed the controllers of all the companies to reject the claims, and said that these being of the nature of test cases the costs of all parties would be paid out of the assets of the companies.

Breach of Contract for the Sale of Calcium Carbide. *Acetylene Corporation of Great Britain, Ltd. v. Canada Carbide Co., Ltd.*

On July 28 the Court of Appeal, consisting of Lords Justices Bankes, Warrington, and Scrutton, terminated the hearing of an appeal by the Canada Carbide Co., Ltd., the defendant company, and a cross-appeal by the Acetylene Corporation of Great Britain, Ltd., the plaintiff company, from a judgment of Mr. Justice Rowlatt given on March 9, 1921 (*cf.* J., 1921, 113 R), in an action for damages for alleged breach of contract by the defendant company to ship large quantities of calcium carbide from Canada to the United Kingdom for resale by plaintiff company to the Government.

The defendant company claimed that the suspension of the contract between July, 1916, and July, 1920, owing to causes arising out of the war, was of such a character as to involve a frustration of the contract, so that it was entitled to succeed on the claim laid against it for damages; the ground of frustration constituted an answer to the whole case. Mr. Justice Rowlatt had held that although there was long suspension, there was not frustration, and therefore directed that there should be an inquiry as to damages based on the assumption that there had been a repudiation of contract. That inquiry stood over pending this appeal.

For the plaintiff company it was claimed that the contract provided that the Corporation was to control all the business of the Carbide Co. in the United Kingdom during the currency of the contract and was to have the right of pre-emption at a reasonable price of such goods as the latter company allocated to the United Kingdom for the twelve months after the period of the contract. All the trouble had arisen from the breach of the control clause, because if the goods had been supplied the Corporation would have found ample shipping facilities. These points concerning control and pre-emption had been decided in favour of the Carbide Co., and it was against these decisions that the appeal was made.

Lord Justice Bankes said that the Court had come to the conclusion that the Carbide Co. had committed a breach of the agreement as to control, and was liable to the Corporation for such damages for breach as might be awarded by the Referee. The long continuance of the period during which deliveries were suspended, however, had so affected the identity of the contract that it was no longer binding, and the Carbide Co. was no longer obliged to give the Corporation the first refusal of the carbide for the year succeeding the termination of the contract; Mr. Justice Rowlatt was justified in refusing relief under this head. The Corporation could not recover directly for the alleged breach of the earlier contract for deliveries between July—December, 1916, and was not entitled to treat the short delay which occurred after December, 1916, before deliveries commenced, as a breach of contract. Mr. Justice Rowlatt's judgment was varied accordingly, each party being awarded the costs of the issues upon which it had succeeded, and each being given the costs of its appeal.

REPORTS.

Annual Report of the Chief Inspector of Factories and Workshops, 1920. *Pp.* 173. *London: H.M. Stationery Office.* 1921. [*Cmd.* 1403.] *Price* 1s. 6*d*.

The year 1920 was marked by an unusually sudden and complete change from prosperity to depression in all industries excepting those connected with building. Nevertheless, there were some developments of note, such as the erection at Skinningrove of an electrostatic plant for the separation of blast-furnace dust, and the inauguration of a dead-meat industry on American lines at Drogheda. The work of inspectors has been particularly directed towards the standardisation of safety precautions in important trades and the conversion of codes of Special Rules into Regulations for white-lead factories, chemical works, vulcanising indiarubber, etc.

During 1920, 138,773 accidents were reported, of which 1404 were fatal, the increase over 1919 being 12,750. It is pointed out that two-thirds of the total accidents in factories are not due to machines; and also that in educating the worker to an appreciation of danger special attention should be paid to very young persons just entering industry. There were five cases of bursting hydro-extractors, and attention is called to the need for a high "factor of safety" when the cage is made of copper; there were other accidents connected with these machines which can only be prevented by the provision of automatically locking covers. Several explosions were caused by petrol, naphtha, etc.; in an indiarubber factory failure to remove naphtha from a roll of fabric impregnated with rubber solution before heating the fabric led to a fatal explosion. There were two explosions during repairs to tanks which had contained petrol, and others in connexion with acetylene and coal gas. A fatal accident in a chemical works was due to the detonation of perchlorate of potash mixed with organic matter. During the distillation of nitrobenzene in a fire-heated still an explosion was caused by the presence of dinitrobenzene; steam heating should be used for such processes. Owing to an explosion of a directly-fired oil-heater supplying oil for heating purposes, attention is called to the danger of heating oil in bulk due to the accretion of solid deposits upon the surface of the container; the more modern pipe-systems are to be preferred.

There were 243 cases of lead poisoning, 47 of which occurred in connexion with electric accumulators. Considerable expansion in this industry has followed the development of the motor industry, and attention is directed to the necessity of cleanliness and orderliness and for ventilation in the workshops. An exhaustive inquiry has been made into processes and methods used in the grinding of metals in different industries. The dust produced from sandstones has been especially studied, and in view of the fine size and siliceous nature of such dust, the use of manufactured abrasive wheels is recommended. A similar dust is produced during the grinding of ganister and other refractory materials.

Steady progress towards improved conditions is noted in the chapters dealing with Health and Sanitation, Welfare, Lighting in Factories, and First Aid. A general description of the processes connected with sugar-refining is given, with special reference to the difficulties caused by excessive working temperatures and to the objectionable work of spreading bone charcoal by hand in the filters.

In the chapter on Industrial Diseases, Dr. T. M. Legge compares conditions in this country with the system of medical supervision in American factories. A marked feature of the latter is the absence of national insurance against sickness, but, as large employers realise the economic advantage of having healthy workers, close medical supervision is provided. The increase in the number of reported cases of lead poisoning (from 207 to 243) was due mainly to one factory where lead smelting is carried on. Analyses have been made of fume and dust produced in the accumulator industry, and it is concluded that if the air breathed contains less than 5 mg. per 10 cb. m., cases of encephalopathy and paralysis would never, and cases of colic very rarely, occur. There were five cases of mercury poisoning, and the atmosphere of workrooms in which clinical thermometers are made is being investigated. Paranitrochlorobenzene was responsible for a case of toxic jaundice, and other cases were due to arseniuretted hydrogen evolved from zinc and hydrochloric acid. Among the reported cases of gassing, carbon monoxide caused 56, sulphuretted hydrogen 13, benzol, naphtha and aniline 12, nitrous fumes 9, and chlorine 8. Dermatitis comes under investigation with increasing frequency; some of the cases were caused by paraffin, dinitrochlorobenzene, pitch, tar oil, strong alkaline solutions, nitrate of mercury, salts of morphia, quinine sulphate, and chromium chloride. A committee of the Royal Society which is investigating the subject of glass workers' cataract finds strong evidence in favour of the view that heat rays emitted by the molten glass are responsible for this disease. Examinations of the dust in printers' workrooms have shown it to consist mainly of vegetable fibre and carbonaceous matter and to contain very little silica.

Report on the Industrial, Commercial, and Economic Situation in Poland, dated March, 1921. *By* R. E. Kimens, *Commercial Secretary to H.M. Legation, Warsaw. Pp.* 67. *Department of Overseas Trade. London: H.M. Stationery Office.* 1921. *Price 2s. net.*

Present-day Poland comprises the former Russian, or Congress Poland, Western Galicia (formerly Austrian), and Posnania, a pre-war German province. The population numbers about 21 millions, and the chief occupation of the people is agriculture. Coal is produced in insufficient quantity to meet the country's requirements, even at the present time, when industrial production is 60 per cent. below the normal; the coalfields in the Dombrowa, Cracow and Teschen basins could be developed, but the capital outlay required would be great. The future of the coal industry is bound up with the future of Upper Silesia—a remark that also applies to the mining of iron ore. The latter occurs in the south-west of Congress Poland, but is of poor quality and was formerly smelted along with richer ore from South Russia. The production of zinc ore is likely to remain small, but that of salt (*cf*. J., 1920, 438 R) could be very considerably increased. Potash is won at Kalusz by the "Kali" company, whose capital is being increased to 27½ million Polish marks (Polish mark=11¾d. at par, now about 0·03d.); recent production has been at the rate of 5000 wagons per annum, but ten times as much could be produced if more wagons for transport were available (*cf*. J., 1920, 400 R). Copper, lead and sulphur ores are mined to a small extent in the Kielce basin, but ozokerite production has been falling off, only one company now operating. Petroleum production is the chief industry of Galician Poland; there are 578 wells, 29 refineries, and 34 operating companies, of which 9 are Polish, 8 French, and 1 English. Mineral production in the areas comprising present-day Poland was as follows in 1913 and 1920:—

	1913. Tons.	1920. Tons.
Coal	8,988,581	6,403,707
Brown coal	192,489	251,822
Iron ore	330,057	110,000
Zinc ore	70,648	64,354
Salt	187,097	245,604
Sulphur	—	264
Petroleum, crude	—	733,325

Of the industries based directly upon agriculture, alcohol, brewing, starch, and sugar are the more important. Alcohol is made exclusively from potatoes, and its sale is controlled by the Government. In 1920–21 there were 760 distilleries, which produced 11,495,000 galls. of alcohol, of which 7,040,000 galls. was consumed in the country. Production could be considerably augmented, and increasing quantities should be available for export. Out of 357 breweries which existed before the war in Congress Poland, Galicia, and Posnania, about 60 per cent. is now working, the remainder having been destroyed. The entire production is consumed in the country. Starch production was seriously affected by the war, only 900 tons being made in 1920, compared with 19,500 t. in 1914; about two-thirds of the production was formerly exported. The yield of sugar in 1919–20 was very poor, the estimated production of the 37 factories in Congress Poland being 24,606 t., as against 81,247 t. from 53 factories in 1913–14; prospects for the season 1920–21 are much better. All the paper mills which were damaged during the war have been rebuilt, but production is insufficient for the country's requirements owing to the scarcity of pulp. Formerly about 25 per cent. of the output —mostly cheap qualities—was exported to Russia, and about the same amount of good qualities was imported from Finland. The nine match factories produced 65,000 cases (of 5000 boxes each) in 1920, and the estimated production for 1921 is about 105,000 cases. The annual consumption is 120,000 cases.

The future of the chemical industry will depend largely upon the fate of Upper Silesia; if this province becomes Polish, the production of acids and superphosphates will not only cover local demands, but there will be a surplus for export to Russia, but if it remains German these demands will not be satisfied when the industries of the country are fully restored. As the cost of production of sulphuric acid in Upper Silesia, as a by-product of the zinc-smelting industry, was lower than that made in Poland from pyrites, much acid was sent from the former country to the latter, but owing to a trade agreement prices were kept at a satisfactory level for the producers. At present there are 10 sulphuric-acid factories, nearly all of which can also produce nitric acid; hydrochloric acid was produced in a few works prior to the war. Manufacture of superphosphates was restricted owing to German competition, but was profitable owing to prices being controlled by a trade syndicate. Of the four works which existed in Congress Poland, only one remains, and there are two in Posnania and one in Galicia. The mineral phosphate used before the war came mainly from America and Algeria.

The raw materials used in dyestuff manufacture were all obtained from Germany, and are likely to be in the future; there are four factories. Ultramarine is produced in two factories, and ochre, which occurs in large deposits in Galicia, will be exported in the future. Glue manufacture was well developed before the war, and the industry will be able to export to Russia. The future of the manufacture of pharmaceutical products, as yet hardly developed, is uncertain; alum is produced in one factory and soda in two. The soap industry is a very important one; before the war there were 64 factories in Congress Poland which produced annually about 4000 t. of soap, exclusive of that made by the textile factories for their own use; 95 per cent. of the entire production was consumed in the country. The tanning industry was also important, but it is now stagnating as the machinery was dismantled by the Germans, and hides and tanning materials are very scarce. Cement manufacture was formerly very prosperous, but production has fallen off of late owing to the shortage of coal; 615,000 t. was produced in 1913 and 215,500 t. in 1920; the output capacity is 1,200,000 t., and the industry has good prospects. The glass industry is gradually recovering, the production in 1920 was 57,000 t., or about 30 per cent. of the pre-war average, and the number of factories 28. As the Russian market is closed, attempts are being made to export glass to France, Rumania, and Italy. Iron-smelting was an important industry in Congress Poland; in 1920 the output of pig iron was about 30 per cent. of that in 1913, but the demand is large and developments should be satisfactory, especially if the Upper Silesian question is settled in favour of Poland.

Annual Report of His Majesty's Inspectors of Explosives for the Year 1920. *Pp.* 29. *H.M. Stationery Office*, 1921. [*Cmd.* 1324.] *Price* 3*d. net.*

There has been a further substantial reduction in the number of factories on the books, mainly due to the amalgamation of all the chief manufacturers into one firm now known as Nobel's Industries Limited. The net reduction during the year was 14, and the total number is now 133.

The number of factories in existence during the period 1885—1920, with the number of persons employed, is given as follows:—

Year.	Factories.	Employees.
1885	108	7,484
1890	123	9,820
1895	134	10,023
1900	150	11,098
1905	148	14,567
1910	139	14,590
1920	133	13,103

There were 76 accidents in manufacture during 1920 which caused 2 deaths and injuries to 44 persons. The total number of accidents reported during the year was 438, causing 50 deaths and injuries to 455 persons. The averages for the years 1905 to 1914 were:—Accidents 434.5; deaths 56.1; injuries 433.9.

The total quantity of explosives imported during the year was 433,659·5 lb., of which aluminium torches accounted for 389,989 lb.

The chemical advisers report the examination of 366 samples, of which 30 were special samples taken in connexion with accidents in mines. The number of samples reported as unsatisfactory was 75, and attention is drawn to the fact that this is unusually high. The number of new explosives submitted was only 13 of which 11 were passed and 2 rejected.

Some experiments were carried out in the presence of two of H.M. Inspectors at Harefield Park, Middlesex, on liquid-air explosives, the results of which are said to have appeared satisfactory. The Testing Station at Rotherham was transferred in December to the Mines Department; further experiments, using natural methane gas instead of coal gas, were carried out there during the year.

The total quantities of explosives used in mines and quarries from 1915 to 1919 are given as follows:—

1915	30,215,155 lb.
1916	30,801,227 lb.
1917	31,737,651 lb.
1918	29,869,677 lb.
1919	27,139,391 lb.

TRADE NOTES.

BRITISH.

East Africa Protectorate in 1918-19.—The industries of this Colony, now known as the Kenya Colony and Protectorate, include agriculture and stock-raising, mining, and forestry. During 1918–19 climatic conditions were very unfavourable and adversely affected agriculture, of which the main products are cotton, coffee, flax, sisal, maize, potatoes, sugar-cane, swamp rice, coconuts, and fruit. The sisal industry was very prosperous, new estates were put under cultivation, and the average monthly output was about 500 tons. The Chief of the Economic Plants Division inspected the Kibos and Kibigori districts and reported that the soil and climate were highly favourable to the successful cultivation of sugar-cane. Owing to the continuance of the war, private mining enterprise was at a standstill. The demand for mica by the Ministry of Munitions resulted in mining being undertaken at Sultan Hamud and at Chuka, on the slopes of Mount Kenya. About 20 tons of crude mica was produced and 2 tons finished by cutting was sent to England; development had reached a paying stage when owing to the armistice the demand ceased and work was stopped. The demand for timber continued to be in excess of the supply; 459,836 cb. ft. was sold, compared with 389,121 cb. ft. in 1917-18.

The trade statistics include the returns for the East Africa and Uganda Protectorates. Imports increased by 21 per cent. to a value of £3,397,810, and exports by 45 per cent. to £2,231,827. Among the latter were:—Cotton 5459 t. (Uganda), coffee 6770 t., carbonate of soda 12,007 t. (Lake Magadi), sisal 5600 t., flax 253 t., hides and skins £150,012. The United Kingdom and British Possessions supplied, respectively, 48 and 31 per cent. of the total imports, and took 53·5 and 37·6 per cent. of the total exports.—(*Col. Rep.-Ann., No.* 1073, 1921.)

Imports of Chemicals, etc. into South Africa in 1920.—The total value of imports into the Union of South Africa during 1920 was £105,927,107, which compares with £53,118,612 in 1919. Values of chemical and related imports are given below, together with the percentages supplied by the chief countries of origin.

	£	Per cent.
Asbestos	112,459	U.S. 59, U.K. 35
Brass, all kinds	102,203	U.K. 74, Jap. 14, U.S. 6
Calcium carbide	53,904	Can. 63, Nor. 21, Swed. 12, U.K. 3
Cement	118,484	U.K. 75, Can. 17, Belg. 4, Ger. 3
Copper, all kinds	46,010	U.K. 86, U.S. 11
Fertilisers—		
Basic slag	46,187	Belg. 52, Holl. 46, U.K. 1
Bone fertilisers	11,258	Madagascar 85, Argentine 8
Guano	1,822	Seychelles 80
Sodium nitrate	850	Chile 100
Phosphates, raw	28,267	Egypt 100
Potash fertilisers	11,831	Holl. 49, Ger. 37
Superphosphates	133,423	U.K. 58, Holl. 26, Ger. 1
Whale manures	3,836	Falk. Is. 99
Fertilisers, other	2,305	U.K. 94
Lubricating oils	475,538	U.S. 95, U.K. 4
Motor spirit, benzine and naphtha	1,407,305	U.S. 59, Dutch E. Ind. 37
Paraffin oil	709,119	U.S. 100
Oils, other mineral	40,424	Dutch E. Ind. 68, U.S. 28
Grease, anti-friction	112,459	U.S. 59, U.K. 40
Potassium cyanide	3,863	U.K. 100
Sodium cyanide	340,032	U.K. 74, Ger. 12, U.S. 11
Sodium arsenite	33,895	U.K. 76, Australia 24
Disinfectants, insecticides, etc.	120,397	U.K. 92, U.S. 0
Indiarubber, gutta-percha and manufactures of	1,396,884	U.K. 40, U.S. 39
Asphalt and bitumen	17,301	U.S. 48, U.K. 40
Creosote	4,071	U.K. 100
Pitch	3,014	U.K. 78
Tar	71,136	U.K. 88
Tar substitutes	21,660	U.K. 81, Mex. 17
Zinc and zinc manufactures	107,868	U.K. 74, Australia 19

—(*S. Afr. Eng., June*, 1921.)

COMPANY NEWS.

NOBEL INDUSTRIES, LTD.

Presiding at the ordinary general meeting, held in London on July 29, Sir Harry McGowan said that although the profits earned in 1920 were approximately the same as for 1919, the directors had decided to recommend no dividends upon the ordinary and deferred shares on account of the necessity for conserving the company's resources in view of the industrial crisis and the uncertain financial outlook. The company was in a very healthy condition as regarded stocks of materials and commitments ahead. The amount received as dividends from subsidiary companies was £1,200,000 gross or £850,000 net, compared with £1,655,000 for the two years 1918 and 1919, and the sum now to be carried forward was £757,498, as against £230,389 brought in (issued capital Dec. 31, 1920, £15,738,427). The object of the amalgamation (*cf.* J., 1918, 462 R) had been to secure the following advantages:—In the factories—(1) To reduce production costs and overhead charges by concentration of manufacture in the most suitable places; (2) to be able at no greater overhead cost to have everywhere the highest technical advice; (3) to buy more cheaply and to economise by holding smaller stocks of raw material. In the selling organisation—(4) to eliminate competition in advertising, and increase efficiency in that direction; (5) to effect savings in distribution expenses, *i.e.*, commissions, magazine charges, carriage, etc. In the office organisation—(6) to establish a common form of costing in order to get the advantage of comparability; (7) to get the best advice and establish a common line of action in fiscal matters; (8) to concentrate in a central modern office building, with consequential time-saving and efficiency. In finance—(9) to get better knowledge and advice in regard to employment of surplus funds and on general questions of foreign exchange, to save interest, and to economise in current bank balances. After two year's working, he could say that to a large extent these objects had been attained.

Dealing with the company's industrial investments, Sir H. McGowan said that £3,400,000 had been invested in the General Motors Corporation of America. Although the shares of this Corporation had recently been quoted at $10·5, a recent independent valuation of its physical assets had shown that the surplus of assets over liabilities was $17·5 per share. He was confident that the investment would prove remunerative. The extent of the company's holding in the British Cellulose Co. was £300,000, or only 6·1 per cent. of the total capital (of Nobel Industries), and its investment in the Dunlop Co. could to-day be realised at a comparatively negligible loss. The small holding in the British Dyestuffs Corporation was acquired for £200,000, and represented only 3·4 per cent. of the total capital; and the largest remaining investment of a marketable character was in Canadian Explosives, Ltd., which was working most successfully under the present adverse conditions.

MOND NICKEL CO., LTD.

The seventh annual general meeting of this company was held in London on August 5. Mr. Robert Mond, who presided, said that the works at Clydach, which had been closed down owing to failure of coal supplies, would shortly be re-opened. As a result of joint action by employers, acting through the Chemical Employers' Federation, the wage of labourers had been reduced to 1s. 5d. per hour, and that of shiftmen to 1s. 7d. per hour, but these were still 146 and 201 per cent., respectively, above the pre-war rates. In Canada also the employees had accepted the inevitable reduction. Sales during the year had been fairly satisfactory in volume; the bulk of the stocks of nickel metal and scrap which had accumulated during the war had been absorbed; and when the balance was disposed of, a considerably increased demand for the metal was to be expected. Selling prices had been unduly low, having regard to the cost; depreciated exchange of the currencies of France, Italy, Greece, Rumania, etc. accounted mainly for the low prices obtained for copper sulphate in these markets, and the price of nickel would have to be raised unless the costs of labour and raw materials could be reduced. In Canada such costs are falling, and similar reductions must take effect here before our pre-war prosperity can be regained. The popularity of nickel was growing steadily and several governments had recognised its superiority for coinage purposes; one important advantage, in addition to its durability, was the practical impossibility of counterfeiting it owing to its magnetic properties. The Italian Government had made large issues of pure-nickel coins, and recently the company had secured a large contract with the Canadian Government for the supply of nickel for 5-cent pieces.

The payment was approved of a dividend of 1s., free of tax, on the ordinary shares for the year ended April 30, 1921. No balance-sheet was presented, pending settlement with the revenue authorities of questions relating to excess profits duty, in which connexion the company is claiming a large sum for repayments and allowances.

OFFICIAL TRADE INTELLIGENCE.

(*From the Board of Trade Journal for July* 28 *and August* 4.)

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W. 1, from firms, agents or individuals who desire to represent U.K. manufacturers or exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department and quoting the specific reference number.

Locality of firm or agent.	Materials.	Reference number.
Australia	Gold, silver and aluminium leaf..	87
"	Paper, boxboard	102
Canada	Manganese steel, hollow hexagon mining steel	88
South Africa ..	Wrapping paper	109
Hungary	Chemicals	111
Italy	Iron and steel sheets and bars, mineral oils, anti-corrosive paints	112
Netherlands ..	Ores, chemicals	94
Switzerland ..	Quebracho extract	D.O.T./ 11155/ F.W./ S.C. 2
China	Glass, glassware	115
Argentina ..	Paint, oils, metals	99
Argentina, Uruguay and Paraguay	Metals, coal, crockery, glassware, commercial chemicals, medicines	100
Chile	Drugs, earthenware	118

TARIFF. CUSTOMS. EXCISE.

Australia.—Recent customs decisions affect many kinds of paper, scientific instruments, methyl alcohol, acetone, and coppered steel wire.

Belgium.—The import of colours of German origin, sugar, syrup and molasses is still subject to control.

Among the articles the export of which is still subject to control are cement, tiles, wood, gold, silver, fertilisers, sugar, syrup, molasses, yeast, and alcohol.

Costa Rica.—Gold and silver may be exported as from June 16.

Denmark.—The prohibition of the import of sugar and goods containing sugar is to be raised as from November 1.

It is proposed to revise the customs tariff in the near future.

Egypt.—The import tariff valuations of iron and steel manufactures are given in the issue for July 28.

French Colonies.—Sugar may now be exported to all destinations.

Do. in Oceania.—Modified export duties are payable on phosphate of lime, coconut oil, copra, and vanilla.

Germany.—The export of "Sanatogen" is prohibited as from July 15.

Condensed and dried milk may be imported without licence as from September 15.

India.—"Enteronol" or "Cholerol" is included in the list of preparations containing opium the importation of which is permitted under the proviso to the Notification No. 720—79 of February 4, 1911.

Manufactured mica is exempted from import duty as from July 2.

Mexico.—Modified import duties are payable on untanned skins, lard, lard compound, and sugar.

The export of cocoa is prohibited as from June 7, and the export duties on petroleum and its products have been modified.

Norway.—Sole leather and soles ready cut pay an additional duty of 50 per cent. as from July 1.

Poland.—Among the articles the export of which is absolutely prohibited as from July 4 are sugar, yeast, salt, fertilisers, bones, charcoal, metallic ores and minerals of all kinds, scrap iron and steel, waste paper and rags.

Rumania.—A copy of the new customs tariff may be seen at the Department.

San Salvador.—Increased import duties are payable on perfumery, oils, soap, cement, galvanised iron, and iron bars, sheets and ingots for building purposes.

Serb-Croat-Slovene State.—The new customs tariff came into force on July 16.

Spain.—Articles the export of which is prohibited include gasoline, iron and steel waste, petroleum, waste paper and rags. Articles that may be exported only under certain specified conditions include charcoal, common soap, tanned hides and skins, cement, olive oil, and sugar.

The new Draft Tariff is issued as a supplement to the issue of July 28. Up to September 8 the Spanish Customs Board will be prepared to receive representations and petitions on the subject of the tariff proposals from industrial or commercial bodies or private persons. The rates of duty are those which took effect as from May 21 and modified in a few particulars by a Royal Order of June 3.

Tunis.—Export prohibitions have been removed from bauxite, iron ore, edible fats and margarine.

An export duty of 5 fr. per 100 kg. has been levied on edible oilcake.

United States.—The proposed new customs tariff is issued as a supplement to the issue of August 4. Among the articles contained in the import free list are chromic, nitric, sulphuric, hydrofluoric and hydrochloric acids, certain crude vegetable drugs, albumin, antimony ore, certain vegetable colours, arsenic sulphide, asbestos, azides, fulminating powder, casein, cinchona bark, bismuth, crude bones, bone meal, bone ash, borax, borate of lime, scrap brass, Burgundy pitch, cadmium, certain calcium salts, cerium, cerite, chrome ore, certain crude coal-tar products, cobalt, cobalt ore, copper ore, certain salts of copper, cocoa, cryolite, unwrought metals, vegetable tanning materials, corundum, copperas, fertilisers, gums, resins, glue stock, raw hides, crude iodine, the platinum metals, rubber, gutta percha, iron ore, kieserite, asphalt, bitumen, wood pulp, crude minerals, thorium ores, certain oils, crude phosphates, certain potash salts, radium, selenium, certain soda salts, strontium ores, sulphur, wood tar and pitch, tin ore, turpentine, rosin, uranium oxide and salts, wax, and witherite.

REVIEWS.

I. The Formation of Colloids. *By* The Svedberg. *Monographs on the Physics and Chemistry of Colloids. Pp. viii.+127. (London: J. and A. Churchill.* 1921.) *Price 7s. 6d. net.*

II. Kolloidchemie der Eiweisskörper. Part I. *By* Prof. Wo. Pauli. *Pp. viii.+117. (Dresden and Leipzig: Th. Steinkopff.* 1920.) *Price, paper,* 10 *mk.*

1. It is not often that a reviewer has an opportunity of expressing such unreserved approval as is possible in bringing Prof. T. Svedberg's little monograph on the "Formation of Colloids" to the attention of all interested in colloids. That Prof. Svedberg is the outstanding authority on the preparation of colloidal solutions was shown by his larger work of reference in 1909. He has now written a most readable and suggestive account of the various ways in which matter may be brought into colloidal form. Within the compass of a little more than 100 pages, he has managed to include the most varied and stimulating information. This is supplemented by the inclusion, without detriment to the text, of nearly 200 references to the most important original papers and books.

The subject matter is very clearly arranged, and passes from a brief mention of general principles and a similarly brief treatment of phenomena observed *in vacuo*, to the formation of disperse systems in gases. The remaining half of the book is chiefly devoted to observations in liquids. This brief outline, however, does not do justice to the scope and variety of the examples to be found on almost every page, varying from laboratory experiments to naturally occurring phenomena and important industrial operations. Indeed, this last appears particularly valuable in placing in a new light so many industrial observations whose explanation has been obscure. Another very pleasing and unusual feature is to be found in the numerous references to the historical literature, including facts recorded as early as the 18th century.

It is with mixed feelings that one notes that a whole series of these monographs is in preparation, for if the quality of the present one is maintained, every student of the subject will find himself compelled to purchase a copy, although the total amount of text may be considerably less than in one or two of the bigger treatises at a similar price. However, the paper and printing are excellent, and the illustrations numerous and clearly arranged. This little book is certain to enjoy an extensive sale and to attract the attention of wide circles to a consideration of this fascinating subject.

II. Prof. Pauli's monograph on "The Colloid Chemistry of Proteins" is of a different character, and it constitutes a very great achievement. It brings together in masterly summary the results of the extensive investigations carried out by Pauli and his numerous collaborators, who have partly built upon the earlier work of W. B. Hardy and others. Through this work there is now possible a comprehensive survey of the physico-chemical behaviour of these substances, so fundamental in their importance to biology and medicine.

With extraordinary ingenuity and sureness of treatment, the most important quantitative methods of physical chemistry have been applied to these exceptionally difficult and elusive materials. Measurement of hydrogen and chlorine ions by electromotive force, of conductivity, migration, osmotic pressure and viscosity are combined to deduce the last shred of significance from the behaviour of the proteins alone and in the presence of acids, alkalis and salts, and, where necessary, bold and simple hypotheses are made use of to bridge gaps, only to receive remarkable confirmation from later work.

Pauli first briefly summarises the concepts of colloid chemistry, emphasising the stabilising effect of hydration even at the isoelectric point. There remains, however, a strong impression that the foundations of this branch of science have still to be laid, and that it is just in regard to the more obvious questions that secure and accurate knowledge is most lacking. Pauli tends strongly towards a more chemical conception of colloidal solution in all cases, in reaction against the almost purely physical conception of suspension colloids now current.

Seven more chapters follow, each dealing with one aspect of the behaviour of proteins and their derivatives: dissociation, isoelectric point, acid solutions, hydrolysis, alkaline solutions, effects of time, migration, and electrochemical equivalent of proteins.

It is hardly possible to summarise here in useful form the great variety of reactions and characters shown under different circumstances by this class of substances whose chemical formulæ, constitution, and even molecular weight are still subjects of investigation. They are notorious for their responsiveness to the slightest change in environment, and indeed, it is partly upon this that the mechanism of life processes depends. Even the purely chemical reactions are susceptible of almost infinite gradation. Herein lies the difficulty of securing exact explanations and trustworthy hypotheses; there is always the danger that the number of assumptions is comparable with the number of facts to be explained. All the greater, therefore, is the achievement in having now attained such substantial progress, so that several types of behaviour appear to be finally explained, whilst for the remainder a comprehensive system of hypotheses is available for grouping what is already known and as a guide to further experiment.

Pauli's work has been to establish the nature of alkali and acid albumins as electrolytic colloids or colloidal electrolytes. The alkali caseins are analogous to the neutral salt of a moderately strong acid: one molecule dissociates into three ordinary sodium ions and a trivalent colloidal anion to which in some cases an extra molecule of neutral casein is added. These results revise the earlier and well-known conception of T. Brailsford Robertson, to whom, however, the credit is due of having gone ahead with the attempt to systematise and greatly extend our knowledge of this most complicated subject. Unfortunately, Robertson was led to adopt the hypothesis that both ions were colloidal, each containing the protein molecule, so that simple ions were assumed not to occur.

This monograph, indispensable to serious students, should also appear in an English edition. This would greatly extend its influence and accessibility. A second part is promised, dealing with the numerous groups of substances of organic and inorganic origin whose behaviour bears resemblance to that of the proteins. J. W. McBain.

Coke-oven and By-product Works Chemistry. *By* T. Biddulph-Smith. *Pp.* 180. (*London: Charles Griffin and Co., Ltd.* 1921.) *Price* 21s. *net.*

For many years crude tar and sulphate of ammonia were the only subsidiaries of the by-product coking industry. The present position of the industry represents a great advance on these conditions, and the modern coke-oven chemist must be alive to the possibilities of an ever-extending field of operation. The realisation of the value of benzol and, more recently, of alcohol from coke-oven gas as motor spirit, of coke-oven gas as an important factor in modern lighting problems, and of toluene in the high explosives industry, is in keeping with this extension; and, moreover, the chemical efficiency of a coke-oven plant is a factor of which the value is more fully realised year by year. In view of these facts and of the undoubted scarcity of text-books dealing with this specific subject the work is opportune.

Nine chapters and two appendices are included in the book. Chapter I., dealing with the washery and ovens, is very concise, and in future editions the subject matter should be considerably amplified. The author quotes the Campredon sand-test for ascertaining the coking index, but the writer has found that it is not altogether reliable; and Dr. Dunn's method is worthy of reference. The estimation of soluble and total chlorides should have been included, and a little more detail concerning the nitrogen test would have been more in keeping with the importance of that element in reference to ammonia yields. Chapter II. deals with the gas and includes the estimation of ammonia, tar, naphthalene, cyanogen, and sulphuretted hydrogen. For the estimation of benzol and its homologues the author gives details of the oleum, absorption, and nitration tests along with the vapour pressure method, the freezing method, and Lessing's "dry" process. In Chapters III. and IV. the analyses of coke-oven and flue gases are sufficiently dealt with. In the next two chapters the testing of coal tar and the examination of the intermediate products are very lucidly described and the method for estimating free carbon by Dr. Spielmann and Henry Wood makes a useful addition. In Chapter VII., on the routine tests of the ammonia plant, the author has utilised in a compact form the methods dealing with the complete analysis of ammonia liquor which have been advocated in sundry reports of the Chief Inspector of Alkali Works and amplified by Colman's modifications and test for ferrocyanide, etc. The calorimetry of solid and gaseous fuel and pyrometry follow, and in Chapter IX. the author deals with the usual tests relating to benzol recovery. Here full use has been made of various papers which have already appeared in the technical press, but the author has made a judicious selection and they appear in this work in a form most convenient for reference. The work of such experts as Spielmann, Colman and Yeoman, Spielmann and Wheeler, Northall-Laurie, Spielmann and Jones, etc. offers a wide field for selection, but the personal opinion or experience of the author on any of the methods or combinations of them would have greatly enhanced the value of this portion of the work. As an appendix appears Dr. Spielmann's translation of Weger's "Constituents of Coal Tar and their Properties," revised and modified since its first publication for the Ministry of Munitions, and a series of useful tables concludes the work.

The book is a useful work of reference for the more advanced chemist; a study of its contents will give the average student a valuable insight into the chemistry of a modern coke-plant and, more especially, into that of the by-products.

J. E. Christopher.

OBITUARY.

DAVID BROWN.

David Brown, an original member of this Society, who died on June 21 last, aged 81, had only a few years previously retired from the firm of J. F. Macfarlan and Co., with which he had been associated for fully half a century, and latterly as senior partner. He was educated at the Royal High School and at the University of Edinburgh, where he studied chemistry under Lyon Playfair, and for a year was junior assistant to Dr. George Wilson, professor of technology. Thereafter he proceeded to Glasgow University, where for a period he assisted Prof. Thomas Anderson, and later served on the staff of the Apothecaries' Hall in London. On returning to Edinburgh he joined his father, D. R. Brown, in the business of preparing alkaloids (notably morphine), chloroform, ether, and some minor medicinal substances. To this work Brown applied himself with great diligence and characteristic energy. Under his guidance, the production of the works much increased, several additional manufactures being added, notably salicin and strychnine. He made an interesting investigation on the location of salicin in the bark of various species of *Salix*, and published a paper on the subject. From time to time he contributed notes on chloroform, principally with reference to the conditions under which it decomposes, and on its preservation. Although much occupied with the preparation of opium alkaloids, he did not publish any work upon this subject. Observing, however, that the distillate from opium was acid in reaction, he had sufficient collected to form a well-crystallised silver salt, which proved to be the acetate. The alkaloid oxynarcotine was recognised by Brown as an undescribed compound, and sent to Dr. C. R. A. Wright, who analysed it and published a note on the work.

PUBLICATIONS RECEIVED.

Report of the Rothamsted Experimental Station for 1918-20. *Lawes Agricultural Trust. Pp.* 86. (*The Rothamsted Experiment Station, Harpenden,* 1921.) *Price* 2*s.* 6*d.*

Report of the Fuel Research Board for the Years 1920, 1921. First Section: Steaming in Vertical Gas Retorts. *Department of Scientific and Industrial Research. Pp.* 54. (*London: H.M. Stationery Office.* 1921.) *Price* 1*s* 6*d.*

Memorandum on Carbon Monoxide Poisoning in Factories. *Factory Department, Home Office. Form* 827. *Pp.* 13. (*London: H.M. Stationery Office.* 1921.) *Price* 3*d.*

Utilisation of Bitterns. *By* A. J. Turner. *Department of Industries, Bombay Presidency. Bulletin No.* 2. *Pp.* 14. (*Bombay: Government Central Press.* 1920.) *Price* 4 *annas.*

Bulletins of Indian Industries and Labour. (*Calcutta: Superintendent Government Printing, India.* 1921):—

No. 4. The International Labour Organisation. *Price* 14 *annas.*

No. 5. Proceedings of the Second Conference of Directors of Industries. *Price* 12 *annas.*

No. 8. Indian Factory Law Administration. *By* A. G. Clow. *Price* 7 *annas.*

No. 10. The Washington Labour Conference. Official Correspondence. *Price* 1 *rupee* 8 *annas.*

IMPERIAL CHEMISTRY.

Sir William Pope has placed the Society under a fresh obligation to its retiring President by the sanguine and invigorating address delivered to the Annual General Meeting in Canada. It was conspicuously appropriate to the occasion that he should emphasise that peculiar feature of the Society which constitutes it the apostle of Anglo-Saxon chemical technology; for the Society of Chemical Industry is not merely imperial in character, but, by embracing a large and enterprising membership throughout the North American continent, offers a practical demonstration of that greatly desired community in language, political ideals and scientific development, between the United States and the British Empire, which presents the best security for permanent peace.

In one sense it may be claimed that the President has added a new division to the numerous groups into which our branch of science is already partitioned, namely, imperial chemistry. Surveying with admirable breadth of vision the smooth superiority of Nature's methods in producing many of the most important chemical substances, Sir William laid stress on the climatic variety of the Empire's resources as potential agents in chemical technology. Particularly comprehensive and stimulating are his reflections on the indirect utilisation of solar radiations. Although our present embarrassments in connexion with coal may be only temporary, a time must come when, however willing the workers and however efficient the methods of winning and raising, coal will become increasingly costly and eventually unobtainable. On the slippery principle of "sufficient unto the day," the problems arising from that condition of mundane perplexity have not yet been scratched; but before very long it will need to be recognised that no nation of the temperate zone which rebels against the contemplation of automatic extinction can afford to ignore them indefinitely. Thus it is that valuable public service is being rendered by those who, like Sir William Pope, do not shrink from the unpleasant task of indicating a prominent failing displayed by their fellow-citizens, namely, a disinclination to review the chemical and physical basis of their existence, and systematically to provide the scientific requirements for its continuance. In spite of the daring and ingenious forecasts which have been made in regard to the latent possibilities of intra-molecular energy, no practical advance has yet been made in the direction of harnessing it. Pending such a consummation, solar energy, which includes coal, man-power and water-power, remains the only source at our disposal, and if the multiplication of government departments were an outward and visible sign of inward and spiritual scientific grace, the nation which first established and developed a Ministry of Radiation might reasonably claim to be fitted for racial survival.

The experience of a century, however, has taught scientific men that no reliance can be placed on such lumbering and creaking machines as instruments of progress. Our hope lies in that characteristic of the English-speaking people which, emerging after the Norman Conquest from the crucible of a thousand years, has enabled them, during the subsequent period, to spread their ideals throughout the world. Adaptability to circumstances, the capacity to face an issue, the patient determination to solve a problem, combine to form an attitude of mind which inspires us to envisage the future without dismay, and in such a spirit Sir William Pope has provided felicitous encouragement. In the future, as in the past, scientific enthusiasts will continue to plod their laborious way through the labyrinth of Nature's mysteries. Many will spend their lives, as heretofore, revealing secrets which appear to add but little to the sum of knowledge. Occasionally some great truth will be brought to light and will wring appreciation from an unheeding world. Gradually, but inevitably, the system of education will be modified to embrace the fundamentals and to shed the frills, and civilised man will awake to an era which discerns in clear perspective the real problem which he has to solve, and will adopt the only principles by which he can solve it.

ROTHAMSTED.

The report of the Rothamsted Experimental Station, 1918–20,* affords remarkable evidence of the trend of modern agricultural research. When one considers the work of the Station in its earlier years, and not only its work but the manner in which its work was put before the public, one realises that the ordinary farmer was not without reason in failing to understand or to appreciate its value. The writer can recollect taking a party of Midland farmers to the Station and being met and entertained most courteously and hospitably by the veteran collaborators, Sir John Lawes and Sir Henry Gilbert, and then being conducted to the inadequate and dingy laboratories, where the party was bewildered by masses of figures displayed on huge sheets which were let down from a gallery; the farmers were impressed, but not enlightened: they came away with the feeling that something was being done, but could not realise how that "something" affected their industry. The visits to the fields brought practical results within their vision, but it cannot be said that Rothamsted meant much more than theory to them. To-day all is changed, and the remarks of a farmer who recently paid a visit to the Station show that the practical man realises to the full what science is doing to help his industry, and appreciates this help; but still more may be done by those in charge of the station to bring their results before the practical community and to couch them in a language "understanded of the people."

A farmer who reads the report under review cannot fail to realise that there is no finality in knowledge, even in his knowledge, and that many points on which he has, probably hastily, made up his mind are open to discussion and experiment. He will be gratified to find that his conclusions as to the mounting proportion of labour in the cost of farm operations are amply justified, and if he has not yet properly fixed the position of the tractor in his farm organisation, he will get valuable hints as to the exact position in which it should figure. The cultivation and fertiliser investigations will make him think whether, in view of rising costs and falling prices, he can afford to be content with his ancestral habits, and will turn his attention to new sources and improved uses of fertilisers. The question of the making, storage, and use of farmyard manure has often been discussed by scientists, but Rothamsted is now concentrating on the practical side of the question and results are promised which, in these days of a shortened supply owing to the restricted use of horses in towns, may be of the utmost importance. The farmer has in the past not been aware of, and has therefore not been able to take advantage of, the co-operation of the flora and fauna of the soil in his work of food production. Rothamsted is now indicating to him the conditions under which he can secure the maximum benefit from such co-operation, conditions which he can fulfil with ordinary methods of careful cultivation and manuring, whilst investigations are also being carried on to reduce the ravages of injurious insects by a careful study of their habits, life history, and vulnerable points.

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* Report of the Rothamsted Experimental Station for 1918-20 Lawes Agricultural Trust. Pp. 86. Harpenden, 1921. Price 2s.6d

These are only some of the points of practical interest in the report, and hearty congratulations must be offered to the Station, not only for the extensive character of its researches, but also for the plain and practical way in which they are set out in the report.†

THE PHOSPHATE INDUSTRY.

II.—SUPERPHOSPHATE.

W. PACKARD.

This article does not pretend to be a scientific treatise on the process employed in treating phosphate rock with acid, but is a general survey of the industry which has grown out of the discovery that phosphate of lime treated with sulphuric acid produced a material readily assimilated by plant-life.

As is well known, the manufacture of superphosphate was first started in England in about 1845 as the result of experiments carried out by Lawes, who discovered that when tricalcium phosphate, which is insoluble in water, is mixed intimately in the finely-powdered state with an equal quantity of diluted sulphuric acid, the readily-soluble calcium monophosphate is produced. The reaction is a simple one,

$$Ca_3(PO_4)_2+2H_2SO_4=Ca(H_2PO_4)_2+2CaSO_4,$$

and as heat is generated with the evolution of steam, the resulting product readily dries if properly mixed, giving a friable material which can be easily pulverised. Superphosphate of lime as it is marketed for agricultural use is not, of course, pure monocalcium phosphate, but contains, in addition to the calcium sulphate formed in the above reaction, the products of all the non-volatile impurities originally contained in the phosphate rock, which vary in amount from 20 to 40 per cent., according to the grade of phosphate used.

Most phosphates contain a considerable quantity of carbonate of lime, *e.g.*, the soft North African varieties contain 12—20 per cent., and Florida pebble 4 to 8 per cent. The presence of a high percentage of carbonate of lime in the phosphate means that sulphuric acid will be used up in generating carbon dioxide with the formation of calcium sulphate; but the manufacturer does not regard this entirely as a disadvantage. He finds in practice that the rapid evolution of the gases tend to promote more intimate admixture and more rapid combination of the acid and the phosphate, with the result that the superphosphate cake is drier and more honeycombed than with a phosphate containing little carbonate. If superphosphate does not dry while hot it will not dry naturally, and manufacturers know to their cost the result of trying to pulverise it in the moist state, when it tends to become pasty and lumpy.

There are also present in certain phosphates appreciable quantities of iron and aluminium oxides which cause a portion of the phosphates rendered soluble by acid to revert to a less soluble form. For this reason manufacturers who wish to obtain a highly soluble superphosphate use a phosphate containing a minimum amount of iron and alumina; and such phosphates command a higher price in consequence. Three per cent. of oxides of iron and alumina is generally considered a maximum figure, but some of the Florida rock phosphates contain only 1—1.5 per cent. This reversion does not manifest itself as a rule until some days after the "super" has been made, and consequently the manufacturer cannot rely on tests made immediately after mixing. This is particularly the case in England where a guarantee of solubility in water has to be given, for, when using a phosphate with as much as 4 per cent. iron and alumina, the content of soluble phosphate is reduced by 2—4 per cent. within a week of manufacture. Another form of reversion has been recently brought to light which is believed to be caused by pressure of the mass when superphosphate has been stored in heaps of considerable depth. It has certainly been proved that at the bottom of such heaps the water-soluble phosphate has reverted to a greater extent than at the top. Reverted calcium phosphate, $Ca_2(HPO_4)_2$, is formed when tricalcium phosphate is treated with a limited amount of sulphuric acid; it follows, therefore, that if insufficient acid is used to form the soluble product, $Ca(H_2PO_4)_2$, the "super" will contain reverted phosphate. On the other hand, if too much acid is used there will be free acid present which has disadvantages apart from the fact that acidity in a fertiliser is harmful to certain soils. Nowadays fertilisers are largely applied to the land by means of mechanical distributors, and a superphosphate containing free acid cannot be got into a suitable condition for sowing.

In certain countries it is held that the reverted phosphate is just as valuable a plant-food as the water-soluble, and it is sufficient to give a guarantee comprising what is known as "available" phosphate. A certain solution of ammonium citrate will dissolve both the soluble and reverted forms, and this test forms the basis of "availability" of superphosphate in America and some Continental countries. Under these circumstances it is not so important to obtain the maximum of solubility, as the manufacturer can run the risk of leaving 2 per cent. or so of reverted phosphate, knowing that this will be included within his guarantee of availability.

In Great Britain, however, and in countries where the Government protects the agricultural community by insisting on a guarantee of solubility in water, it is very important that the manufacturer should produce a "super" containing the maximum of solubility with a minimum of acidity. The proportion of acid required to dissolve the phosphate content of different mineral phophates varies greatly, and it is therefore of the utmost importance to mix the acid and phosphate in the exact proportion. In the writer's opinion the average British manufacturer might with advantage pay more attention to this point. The water-soluble guarantee certainly places a burden on the manufacturer, but the British superphosphate-maker feels that "water-soluble" is a mark denoting the highest degree of purity and takes a pride in his product.

Selection of Phosphate Rock.—In a previous article, the writer dealt with the varying qualities of phosphate rock produced from the different deposits throughout the world, showing a range of from 57—83 per cent. of tricalcium phosphate. It is difficult to understand why certain phosphates are more popular with manufacturers than others. Certainly some qualities are more easily conditioned than others, and it is interesting to note that phosphate from some of the mines in North Africa that are celebrated for giving a "super" which dries naturally and disintegrates easily respond more readily to the citric-acid test than any other.

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† The researches described in the report have been noticed in this Journal as they were published.

The most usual test of solubility of phosphate in a basic slag is a dilute solution of citric acid, and phosphate rocks respond in varying degress to this test. The soft North African qualities show the highest degree of solubility in citric acid, whilst the harder American rocks are less soluble, and it is possible that this has some bearing on the rapidity of the reaction with sulphuric acid.

The highest quality of phosphate rock gives the highest quality of superphosphate, but the manufacturer has the prejudice of the farmer to deal with; and in all countries the farmer is conservative. In England superphosphate was first made from coprolites which gave a product containing about 26 per cent. of phosphate of lime estimated as tricalcium phosphate, and although for many years phosphates of considerably higher assay-value have been used, there are still farmers who insist on having 26 per cent. "super," even though a "filler" has to be used to obtain it.

In most European countries and in America the phosphatic content of superphosphate is stated in terms of phosphoric anhydride, and "super" is graded 12—14 per cent., 14—16 per cent., etc. In England, however, we speak of it in terms of tricalcium phosphate, analyses being always so stated; and guarantees are given, for instance, of 32 per cent. water-soluble, although tricalcium phosphate is not soluble in water and the phosphate actually exists as monocalcium phosphate. This inaccuracy is, however, necessary in order to preserve a standard of comparison for all phosphatic materials.

The North African phosphates of 58—63 per cent. grade give a superphosphate containing 30 per cent. water-soluble phosphate of lime, and the higher-grade African qualities will make a 33—34 per cent. "super." The grade of Florida pebble varieties varies from 68—75 per cent., and from these superphosphate can be manufactured containing from 35—38 per cent. water-soluble phosphate, whilst the Pacific and Curaçao phosphates containing 80—85 per cent. will give 40—45 per cent. superphosphate. It will be seen, therefore, that the manufacturer has a wide field to select from, but, within certain limits, cost at the consuming works per unit of phosphate of lime is the governing factor.

Naturally the hardness of the rock is an important consideration, as the hard phosphates cost considerably more to grind than the soft varieties, and, as previously mentioned, the presence of iron and aluminium compounds is a drawback. Dryness is also a consideration, but apart from these points and the market demand for certain percentages of superphosphate, the selection of the phosphate depends on the cost, coupled with the preference of the works manager for a particular phosphate.

World's Production of Superphosphate.—It is difficult to obtain reliable estimates of the world's output of superphosphate, but it would be fairly safe to assume that in 1913 the quantity of phosphate rock used in the manufacture of fertilisers was about 7 million tons. Converted into superphosphate this would mean over 12 million tons, and knowing that in America alone there are estimated to be 500 million acres of land under cultivation, this does not sound an impossible figure.

In 1913 America was the largest superphosphate producing and consuming country in the world with an output of about 3 million tons. France came next with about 1,800,000 tons, Germany 1,500,000, and Great Britain produced approximately 900,000 tons. It will be seen that these four countries produced more than one-half of the world's consumption, but production in other countries and in the British Colonies was increasing rapidly. Belgium, where cheap sulphuric acid was produced in the manufacture of spelter, was in 1913 exporting large quantities, and Japan was also becoming an exporting country; more recently Italy and Spain have greatly increased their production.

During the war the demand for sulphuric acid for making explosives was so great that superphosphate production had to suffer, and in 1917 the output was reduced to about 6 million tons at the outside. The phosphate mines were depleted of their labour, and immediately following the war the shortage of "super" was so keenly felt that prices rose rapidly, but by the beginning of 1921 the world-wide slump had spread to the fertiliser trade and output of phosphates readily overtook consumption.

It must be remembered, however, that Central Europe is not yet able to pay for large quantities of imported raw material; Russia, formerly a large consumer, is almost completely out of the market and, although the recovery of these countries must be slow, there is no reason to suppose that the consumption of superphosphate in a few years' time will be less than it was in 1913. We must bear in mind also that in the ten years immediately preceding the war the consumption had doubled, and once normal conditions have been re-established it may be expected to increase again.

The use of fertilisers spreads gradually as agricultural education increases and the virgin lands become impoverished by continued cropping; it is estimated that in America alone 123 million acres could be profitably fertilised, whereas to-day it is doubtful whether more than 70 million acres receive any form of plant-food at all. Whether the superphosphate trade will be profitable in the future or not is impossible to predict, but that it will continue to increase seems a certainty once the old pre-war economic conditions are restored.

Superphosphate as a Fertiliser.—The variation of seasons and the differing qualities of soils make it difficult to lay down hard and fast rules as to the efficacy of any particular fertiliser, and so little is known of the way in which plant-food is actually absorbed by the growing crops that farmers are often confused concerning the value of solubility in a phosphatic fertiliser. It is known also that the phosphatic content of superphosphate undergoes a change in the soil, reverting to a slightly less soluble form, and this sometimes leads to the supposition that reverted phosphate must be just as rapid in its action as water-soluble phosphate. Again, it has been proved that with basic slags the citric-acid test is more a relative than an absolute guide to the final availability of the phosphate when actually incorporated in the soil, and one is apt to jump to the conclusion that it is no guide at all. Hence there is much controversy on the relative value of the various forms, and it has lately been suggested in England that ground phosphate rock is as effective as basic slag. There is, however, one point which stands out clearly; whatever may take place in the soil, superphosphate, having all its phosphatic content in the water-soluble form, is much more rapid in its action than any form of reverted or insoluble phosphate, and in these days of intensive cultivation a quickly acting fertiliser is essential. For this reason superphosphate is not likely to lose its place in the front rank, but other varieties of phosphate have their value.

Roughly speaking, the phosphatic content of these fertilisers assumes three forms: the water-soluble, the citrate-soluble or reverted form, and the insoluble, all of which have their place in agriculture. Superphosphate is the only source of water-soluble, basic slag is the chief source of citric-soluble, and untreated phosphate rock, bone meal, bone flour, etc., supply the insoluble. There is, however, always a certain amount of citrate-soluble or reverted phosphate present in certain phosphate rocks and in bone flour, which gives them a higher value than that of insoluble phosphate. For instance, some of the North African phosphates contain as much as 35 per cent. of their phosphate in the citric-soluble state, whereas Florida pebble and Nauru phosphates contain less.

It is known that insoluble phosphate becomes gradually available in the soil, and that in four or five years the whole of the phosphates, even in bone meal, becomes absorbable by the plant. It will be evident, therefore, that the question of solubility or availability of phosphatic fertilisers, other than superphosphate, is a complex one, and it is still further obscured by the fact that basic slag contains a certain amount of free lime, and that soils deficient in lime respond to dressings of basic slag more than soils containing plenty of lime. This shows that in all probability a higher value is placed on the citric-soluble and insoluble phosphatic content of basic slag than is warranted, and the same remarks apply to ground phosphates which contain carbonate of lime.

This brings us back to the point that superphosphate, being the only form of water-soluble phosphate, is not likely to meet with a lessened demand in the future, whatever may be the relative value of reverted and insoluble phosphate, even if there were no other reason than that it gives a quick return for money outlayed.

LAC AND SHELLAC.

The Indian Government has issued a very full report* containing the results of an inquiry initiated by it in order to stabilise the trade in lac and shellac and to safeguard an industry of which India holds what is virtually a world's monopoly. Unfortunately, the industry is encrusted with local prejudice and handicapped by unscientific methods. The propagation and collection of lac are still primitive and uneconomic, manufacture is careless, adulteration rife. Prices fluctuate seriously from season to season, and speculation flourishes in the absence of authoritative reports on crop conditions. A wider knowledge of scientific methods and a closer organisation are necessary to stabilise the trade.

The report contains a detailed account of all that appertains to the industry, including a description of the life-history of the lac insect and its "host"-trees, their distribution and cultivation. Where any choice is possible in the selection of host-trees, preference should be given to those which produce the better qualities of lac. Improved methods of cultivation are suggested and the present methods of collection and storage are given with recommendations for their improvement. A short-sighted policy on the part of the small landed proprietor who is only interested in obtaining a maximum of rent from lac cultivators from year to year with little or no provision for extensions does not foster and increase the cultivation of lac. A careful and definite settlement of lac rents is conducive, in the long run, to careful and profitable cultivation, and the lenient and far-sighted policy adopted throughout the Government Estates of Bihar and Orissa will, it is hoped, be adopted by neighbouring estate-owners (zamindars). The two Governments mentioned would also be well-advised to appoint specialists to supervise the organisation of lac farms and to undertake research into methods of cultivation and collection. Other Local Governments and many States will find it to their advantage to adopt similar methods and the results should not merely be beneficial to private cultivators but should also, with careful organisation, bring in no small increase of revenue.

Methods of shellac manufacture, both manual and mechanical, including costs of manufacture, are fully described in the report, and also the problems awaiting solution. The first step required to stabilise the trade and to stimulate production on economic lines is to ensure a steady supply of sticklac, and the second is to provide an early and reliable forecast of each crop. Increased production is more feasible than has hitherto been supposed. The organisation required for the stick-lac trade, being very complicated, allows the inclusion of several disturbing factors which accentuate the fluctuations of price. As education spreads these disturbing factors, *e.g.*, speculation and adulteration, will undoubtedly diminish; but this is a matter of time. The more direct remedies suggested—the departmental propagation and distribution of brood-lac and the demonstration of improved methods, the preparation and distribution of accurate crop forecasts, the organisation of research work and publication of results—should undoubtedly steady the trade. The greatest importance is attached to the organisation of brood and demonstration farms in order that estate-owners and cultivators may be assured of constant supplies of brood-lac of good quality and may learn scientific methods of cultivation and collection. At present the expenses of collection are considerable, and the risks have to be distributed among a large number of agents, chiefly men of small education and less means.

It is necessary to stimulate production in order that supplies may more nearly equal the foreign demand, which shows every tendency to increase. The following figures indicate the relative consumption in the United Kingdom and the United States of America, which are now India's best customers:—

Average Annual Consumption of Shellac.

		During the five years preceding the war (1909–10 to 1913–14).	During the five subsequent years (1914–15 to 1918–19).
		Cases (containing 2 maunds = 1½ cwt.).	Cases.
U.K.	..	38,000	39,000
U.S.A.	..	119,000	140,000

A detailed scheme is outlined in the report for improved methods of cultivation on intensive lines which might be adopted in Government forests suitable for lac cultivation. In fact, departmental working should, wherever possible, take the place of the present contract system which practical experience has shown to be unsatisfactory.

The report concludes with a summary of recommendations for improving the industry. Co-operative credit societies might be instituted by Government enterprise for the maintenance and distribution of adequate supplies of brood-lac and for co-operative action in the extension of cultivation. The position of the industry will be much strengthened if the possibility of future competition is recognised, and if arrangements are now made for attaining increased efficiency in production and general economic stability. Of the two stabilising methods recommended in the report, the Forest Department is carrying out the first, by the expansion of the area of departmental lac cultivation in Government forests, an area which has hitherto been practically negligible as compared with the total area of cultivation. In connexion with this expansion, it is proposed to create a certain number of "brood-farms" for the production of brood lac and its sale at a reasonably low rate to local cultivators. The second method, *i.e.*, the establishment of some form of research organisation, involves the necessity for engaging scientific officers and financing the work of a lac laboratory, within reasonably easy reach of the headquarters of the industry at Calcutta. These officers would work in close touch with the Forest Department, but in the interest of the trade. A suggested scheme and estimate of the probable total cost are given in the report. Funds for this purpose may be made available by the imposition of a small cess on exports and the funds administered by the Lac Traders' Association now in course of formation in Calcutta.

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* Report on Lac and Shellac. By H. A. F. Lindsay and C. M. Harlow, Officers on Special Duty, Lac Inquiry. Indian Forest Records, Part I., Vol. VIII. Pp. x+162. (Allahabad: Indian Government Publication, 1921.) Price Rs.2–12–0. (To be obtained through Messrs. Grindlay & Co., 54, Parliament Street, Westminster, S.W.1. Price 5s. 6d. net.)

The Appendices contain:—(1) Technical terms used in the industry, (2) a bibliography, (3) suggestions for research, and (4) Local Notes which contain a mass of information that is likely to be of great use to traders. Ten charts are given showing fluctuations in prices in London and Calcutta, stocks held in London and Calcutta and exports of shellac from India. From these charts it is seen that from 1909—1915 the average price of shellac in London was 60s. per cwt., whereas in 1918 it reached the extraordinary figure of 360s. per cwt., and during this period the exports of shellac from India were almost maintained at their former level.

THE CATALYTIC OXIDATION OF HYDROCARBONS, ALCOHOLS AND CARBON MONOXIDE.

The application of catalytic oxidation-reactions in many industrial processes is well known. The following examples may be quoted:—(1) Oxidation of ammonia to form oxides of nitrogen; (2) oxidation of hydrochloric acid in the Deacon process; (3) the partial oxidation of the sulphuretted hydrogen in illuminating and other industrial gases, to form sulphur by the iron oxide in the purifying "boxes"; (4) the method of drying oils by means of certain compounds of lead, manganese, cobalt, etc. if of a catalytic nature, although the mechanism of the reactions is still under discussion; (5) the oxidation of acetaldehyde to acetic acid is usually carried out in the presence of some salt of manganese or copper, or some other catalyst, which, even if it does not accelerate the absorption of oxygen, at any rate causes the continuous decomposition of per-acetic acid, and allows the process to be carried out in safety.

The above reactions are well known. On the other hand, there are several new processes which will doubtless come into prominence in the very near future. Of these it is proposed to consider in this article:—(1) The catalytic oxidation of certain hydrocarbons, omitting the higher paraffin hydrocarbons and their conversion to fatty acids; (2) the oxidation of alcohols to form aldehydes; (3) the oxidation of carbon monoxide to carbon dioxide. Investigation of (3) was stimulated by the necessity of making an anti-carbon-monoxide gas-mask, and has been thoroughly worked out in America (Lamb, Bray and Frazer, J. Ind. and Eng. Chem., 1920, 213).

The Oxidation of Hydrocarbons.

The chief interest in this field, apart from the production of fatty acids from mineral oils (*cf.* J., 1921, 62 R) is the manufacture of products of incomplete oxidation of aromatic hydrocarbons, such as benzene, toluene, anthracene, and naphthalene, in which the hydrocarbons are subjected, so to speak, to an incomplete combustion in the presence of catalysts. The oxides of the metals of the fifth and sixth groups of the Periodic Classification are the most useful catalysts for this purpose, and mixtures may exhibit a greater activity than any of the components used alone. Chief among these oxides are those of vanadium and molybdenum, whilst oxides of chromium, uranium, tungsten, antimony, and bismuth may be used alone or as "promoters."

Before passing to specific established processes, the general method of carrying into practice the catalytic oxidation-reaction with hydrocarbons may be indicated. The hydrocarbon is mixed with air, in excess of that required for the reaction desired, and passed over the chosen catalyst contained in suitably heated tube-furnaces. The effective realisation of a desired reaction may depend upon several factors, amongst which are the form or state of the catalyst, the ratio of oxygen to the hydrocarbon vapour in the mixture, the rate of passage of the mixture, the pressure, the presence of water vapour or of an inert gas, the activity of the catalyst, and so on. Temperature-control is usually the chief difficulty, as is to be expected with these exothermic reactions. This is well exemplified in the case of the oxidation of benzene, considered later. In some cases much less than the theoretical quantity of air or oxygen may be added at first, and the necessary supplement added before passage through the second half of the catalyst mass. The state or form of the catalyst is important, and is shown in a recent patent taken out by the Selden Company of the United States (French Patent No. 515,685). In this disclosure it is stated that vanadium oxide which has been fused above about 650° C., and subsequently broken up into pieces of about 12 mm. size, is a much more efficient catalyst for many oxidations than the finely powdered variety produced from ammonium metavanadate by decomposition at about 300° C. The vanadium oxide also may be brought to the required state of aggregation by incipient fusion at about 500° C. The rate of flow of the mixture of hydrocarbon vapour and oxygen and the presence of inert diluent gases are obviously of importance in assisting the removal of heat from the catalyst, the temperature of which in highly exothermic reactions invariably tends to become much higher than that of the vapour. The effects of other conditions will become apparent in the consideration of specific cases.

The Selden Co., and the Barrett Co., both of America, have devoted much study to the problem of hydrocarbon oxidation. The former company claims that the improved vanadium-oxide catalyst, referred to above, is of use in the following reactions:—

(1) Sulphur dioxide is oxidised to the trioxide at 400° C.

(2) A mixture of methane and air in the proportion of 1:40 is converted into formaldehyde by passage of the mixture over the catalyst at 300° C. Natural gas may be used in place of methane.

(3) Benzene and air, preferably mixed with an inert gas to assist in carrying away the heat of reaction, may be passed over the vanadium catalyst, maintained at about 350°—400° C., when quinone and maleic acid result.

(4) Anthracene mixed with air in excess and passed over the catalyst at about 500° C. yields anthraquinone.

(5) Similarly, phenanthrene gives phenanthraquinone.

(6) Naphthalene in the presence of air and a vanadium-oxide catalyst at about 450° C. (a molybdenum-oxide catalyst requires 500° C.) is converted into phthalic anhydride, phthalic acid, benzoic acid, and naphthaquinone.

(7) A very suitable method of converting the relatively cheap toluene into benzaldehyde and benzoic acid consists in passing toluene vapour mixed with air over a vanadium-oxide catalyst, free from iron impurities, clay, etc., maintained at 350°—450° C. The tendency of the catalyst to become hotter than the vapour-mixture is prevented by adjusting the concentration of toluene vapour in the mixture, by cooling the catalyst artificially, and by other suitable means. The products of the reaction are condensed together and subsequently fractionated, or fractional condensation may be resorted to. The benzoic acid is first easily condensed, and afterwards the benzaldehyde. Unchanged toluene passes on with nitrogen and unchanged air, and the mixture may be adjusted by the addition of toluene or air, and passed again over the catalyst.

(8) Xylene treated in a similar manner may furnish substituted benzoic acids and substituted benzaldehydes.

It is interesting to note in relation to the above process of the Selden Co. for the preparation of a specially active form of vanadium oxide that several of the oxidations which are effected have been known in their fundamental outlines for some time. Thus, Walter (J. Prakt. Chem., 1892) showed that the passage of toluene vapour with air over vanadium pentoxide resulted in the formation of benzoic acid and benzaldehyde. Similarly, Glock, in 1898, showed that formaldehyde could be produced by the catalytic oxidation of methane, in the presence of a copper catalyst, or of pumice, at 800° C.

The Oxidation of Benzene.—The complete oxidation or combustion of benzene leads, of course, to the formation of carbon dioxide and water, but under regulated conditions intermediate products can be isolated. Thus, in the presence of vanadium pentoxide, maleic acid can be obtained in good yield. It has been suggested by Weiss and Downs (J. Ind. Eng. Chem., 1920, 228) that the function of the catalyst is to widen the range of temperature in which the intermediate products of oxidation are stable. The question of temperature control is discussed at length in the above-named paper, and its extreme importance is thoroughly realised.

At high temperatures diphenyl is produced, but in no circumstances of temperature or variation of catalyst could phenol be produced in more than negligible quantities. The original object of the chemists of the Barrett Co. being thus incapable of realisation under all tried conditions, attention was diverted to the establishment of conditions governing the efficient production of maleic acid from benzene. The factors which determine good yields in such catalytic oxidation processes have been indicated above; in the case of the oxidation of benzene to maleic acid—quinone being an intermediate product—the question of temperature-control is of the greatest moment. This is easily realised if the exothermic nature of the reaction be compared with the heat evolved in the case of the oxidation of sulphur dioxide and of ammonia. In the oxidation of benzene to maleic acid it is calculated that 10,560 B.Th.U. are evolved per lb. of benzene treated. With sulphur dioxide the corresponding figure is merely 635·6 B.Th.U., whilst the oxidation of 5 lb. of ammonia to nitrogen oxides produces 5660 B.Th.U. If the reaction gets out of control, destruction of benzene results. Apparatus suitable for the reaction has been patented by the Barrett Co., and consists of a series of catalyst chambers in which the vanadium pentoxide can be cooled by contact with, and by radiation to, cooled surfaces. Adequate control of the apparatus is ensured by the provision of thermo-couples. A quicker passage of the mixture of benzene vapour and air, in which the former is sufficiently low in concentration, enables a quicker dispersion of heat and allows the catalyst-mass and the vapour mixture to maintain approximately equal temperatures.

Maleic anhydride, together with formaldehyde, is accordingly produced by the careful partial oxidation of benzene. Fumaric acid, the stereoisomer of maleic acid, is not produced directly from benzene, but is found in the products, since isomerisation of maleic acid occurs to some extent.

It is scarcely necessary to point out that maleic acid may serve as a valuable raw material in organic syntheses. Malic, succinic, aspartic, tartaric, propionic, lactic, acrylic, hydracrylic, and malonic acids, for example, may be produced from it by well-known reactions. Industrially, too, the production of cheap maleic acid would lead to many new technical applications of organic syntheses.

The Oxidation of Alcohols to Aldehydes.

The fractional oxidation of methyl alcohol to produce formaldehyde, by passage of the vapours mixed with air over reduced copper, is a reaction of technical importance. The yields and progress of the partial oxidation are not all that could be desired, but many improvements have been suggested.

It may be recalled that Sabatier's view was that two reactions occurred in the formation of formaldehyde from methyl alcohol. In the first place, the alcohol is dehydrogenated, whilst simultaneously the liberated hydrogen combines with oxygen to form water, and the reduced copper catalyst is maintained reasonably active:—(1) $CH_3{\cdot}OH = H{\cdot}CHO + H_2$; (2) $H_2 + O = H_2O$. There is, however, a rapid loss of catalytic activity at 350° C., whilst both methyl alcohol and formaldehyde are decomposed with evolution of hydrogen and carbon monoxide:—$CH_3{\cdot}OH = CO + 2H_2$; $H{\cdot}CHO = CO + H_2$.

It was confirmed by Orloff that dehydrogenation of methyl alcohol with reduced copper was not entirely satisfactory for the continuous production of formaldehyde, and better results were obtained when oxygen was added to the alcohol vapour, and both copper and platinum used as catalysts. The reaction thus becomes a partial combustion of alcohol, and not a mere dehydrogenation. Le Blanc and Plaschke found that silver gauze and silver-coated copper gauze were suitable catalysts for the oxidation of methyl alcohol to formaldehyde. Fokin confirmed the activity of a copper-silver alloy in this reaction after an examination of many catalysts. Hochstetter's patents disclose the advantages arising from the use of a "double" catalyst in the partial combustion of methyl alcohol, the catalyst serving to accelerate both the reaction of dehydrogenation and the combustion of the hydrogen produced in the former reaction. The yields of formaldehyde obtained by using, respectively, a copper catalyst, an alloy containing one ten-thousandth its weight of platinum, and a copper catalyst *coated* with platinum, were 70, 72, and 77 per cent. Similarly, the yields with silver alone, silver catalyst in a copper tube, and silver with one ten-thousandth its weight of platinum or rhodium were, respectively, 75, 84, and 96 per cent.

Although reasonably good yields have been obtained in the dehydrogenation of higher alcohols—ethyl alcohol, for example, has been transformed into acetaldehyde on a large scale by dehydrogenation over reduced copper at 300° C., excellent yields being uniformly obtained—continuous working attempted by using oxygen simultaneously has not been successful.

Mignonac (Comptes rend., 1920, 258) has re-examined the question of the oxidation of a large number of alcohols to their corresponding aldehydes. A permanently active catalyst was obtained by depositing silver upon asbestos. The metal was obtained in a finely-divided, reduced condition by treating the asbestos impregnated with a silver salt with formaldehyde. The mixture of alcohol and air was so adjusted that it contained only about 40—50 per cent. of the quantity of oxygen necessary for the transformation of the alcohol to aldehyde. At a later stage, using a second tube, the remaining oxygen was added (as air) and the reaction completed. In this manner the extreme rise in temperature occurring in the fore part of the tube, when the theoretical quantity of air was originally added, was avoided, and decomposition of the alcohol and aldehyde first produced was reduced to a minimum. In many cases the total amount of oxygen added was less than that theoretically necessary for the production of aldehyde. The following table shows the results obtained with various alcohols, the yield giving the percentage of the normal product, namely, the corresponding aldehyde.

	Temperature of catalyst.	*Yield per cent.*
Methyl alcoho	360°—400°C. ..	62
Ethyl alcohol	340°—380°C. ..	89
Butyl alcohol	330°—350°C. ..	93
Amyl alcohol	330°—350°C. ..	94
Benzyl alcohol	300°C. ..	30
Cinnamyl alcohol	—	60—70
Secondary butyl alcohol ..	350°—400°C.	94—96

The process gave excellent results with alcohols of fairly low molecular weight—methyl alcohol excepted—but the results were less successful in the case of benzyl and cinnamyl alcohols. It was found, however, that if the reaction were carried out under reduced pressure, for example 20 mm., and with oxygen as the oxidising agent, the higher alcohols reacted almost as well as ethyl, butyl, and amyl alcohols. Thus, both benzyl and cinnamyl alcohols gave yields of the corresponding aldehydes of 80—90 per cent. (Mignonac and Moureu; Comptes. rend., 1920, 652). Geraniol was also successfully oxidised to citral.

The same features are also observed in the oxidation of alcohols to aldehydes as were noted in the case of the oxidation of hydrocarbons. In these highly exothermic reactions it is of the utmost importance to keep the temperature under rigorous control. A rise in temperature, cumulative in its effects, causes the rapid destruction of the original alcohol and of the desired product. The means which may be adopted to control the reaction are essentially the same as in the case of hydrocarbon oxidation, namely, limitation and regulation of the quantity of oxygen present in the reacting mixture, presence of inert gas, correlation of the speed of flow with the temperature and concentration of oxygen in the mixture, use of efficient catalyst, artificial cooling of the catalyst, and the like.

The Oxidation of Carbon Monoxide to Carbon Dioxide.

I. In the presence of Hydrogen.—The selective combustion of carbon monoxide to the dioxide in the presence of hydrogen is a subject of great importance. The cheapest method for the production of hydrogen on a large scale is undoubtedly the "contact" process, in which the carbon monoxide contained in water gas reacts with steam in the presence of catalysts, thus: $CO+H_2O \rightleftarrows CO_2+H_2$.

Unfortunately, however, the reaction cannot be brought to completion under conditions ruling in technical practice, and the one or two per cent. of carbon monoxide remaining must be removed before the hydrogen can be used in ammonia-synthesis or for the most efficient hydrogenation of oils. The methods in use are well known but are cumbersome in operation compared with a process which would selectively burn the carbon monoxide. The carbon dioxide produced is easily removed, and the diluent nitrogen remaining when air is added to effect the oxidation, would be useful in ammonia synthesis and of little disadvantage in hydrogenation operations.

It is therefore not surprising that efforts have been made to effect the oxidation of the monoxide whilst burning little or no hydrogen. Thus, Harger and Terry (British Patent, No. 127,609, 28.4.17) state that copper oxide will allow of the selective combustion of carbon monoxide at a low temperature, about 100° C. The hydrogen, containing a small amount of the monoxide, is mixed with air in slight excess of the quantity required to oxidise the carbon monoxide, and passed over the catalyst. Carbon dioxide is produced with little simultaneous formation of water. Oxides of iron, chromium, cerium, thorium, manganese, lead, etc. may be used in combination but require a higher temperature. Thus, from an example given in the Specification, a catalyst is made from 194 parts of ferric nitrate, 5 parts of ammonium dichromate, and one part of cerium nitrate. The precipitated oxides are heated to 255° C. and the gas mixture passed over them. It is stated that by using sufficient catalyst to fill a 10 c.c. space, and passing a hydrogen mixture containing 1·5 per cent. of carbon monoxide (with the slight excess of air noted above) at the rate of 15 litres per hour, complete oxidation of the monoxide to dioxide was effected, with little formation of water by combination of hydrogen and oxygen.

The "space-time" factor in this case is well within that technically and economically feasible, but all depends upon the *actual* relative amount of hydrogen burnt. It is insufficient to know that this reaction takes place only to a small extent. It is to be feared that the oxidation is not sufficiently selective to allow of its use in the purification of hydrogen from carbon monoxide in technical practice. The value of the hydrogen burnt to water throws too costly a burden upon the process.

E. K. Rideal has examined this question very thoroughly (J. Chem. Soc., 1919, 993). He has shown that in no case examined is the selective character of the oxidation complete. Catalysts consisting of iron oxide, iron oxide with promoters, such as ceria and chromium oxide, copper oxide, nickel, and palladium, show less selective oxidation of carbon monoxide in the order given. Rise in temperature, moreover, decreases the selective nature of the oxidation. It appears that, in a mixture containing eight times as much hydrogen as carbon monoxide, in no case is the ratio of carbon monoxide to hydrogen burnt greater than about five to one.

The theoretical side of the question is fully treated in Rideal's paper, where it is shown that the velocities of the two reactions occurring simultaneously may be calculated, and that the results agree well with the observed values. It is held that the experiments support Langmuir's theory of adsorption, but the detailed arguments cannot be noted here.

The use of selective oxidation of carbon monoxide contained in hydrogen as a means of purifying the latter is therefore of great theoretical interest, but up to the present its practical application seems incomplete. With a ratio of hydrogen to carbon monoxide of about 99:1, the total removal of the whole of the latter, without burning a very considerable relative proportion of the former, would be difficult, and unless a catalyst is discovered which will effect definitely selective oxidation of carbon monoxide present in low concentration, at a high rate of gas passage, the process will be inapplicable.

However, the idea of selective oxidation is so attractive that further intensive research is called for.

II. The Oxidation of Carbon Monoxide present in Air.—The need of an efficient anti-carbon-monoxide gas-mask for use in peace and war has caused many researches to be undertaken. The collective results of the American workers are described by Lamb, Bray and Frazer (J. Ind. Eng. Chem., 1920, 213).

The complete "chemical" oxidation of carbon monoxide to the dioxide in the cold was a difficult problem, but the experiments showed that the catalytic oxidation was possible under conditions obtaining on the field of battle, or in foul atmospheres existing in closed spaces, for example, in mining operations, below deck on board ship when a defective shell has penetrated the hull and set up incomplete combustion, etc. An efficient anti-carbon-monoxide mask was therefore manufactured, and proved satisfactory in all trials.

The catalyst which will effect the oxidation of carbon monoxide in low concentration in air at normal temperatures consists of a mixture of metallic oxides prepared in a state of aggregation suited to the conditions obtaining in the field. "Hopcalite I," with which gas-masks were charged, consists of a mixture of 50 parts of manganese dioxide, 30 parts of copper oxide, 15 parts of cobaltic oxide (Co_2O_3), and 5 parts of silver oxide. All the oxides were prepared separately by special methods, and mixed in the wet state, with the exception of the silver oxide, which was precipitated from its salt incorporated in the mixture of the other three oxides. The cake was dried under specially devised conditions, pressed into suitable pieces, and screened to the required size.

The mode of preparation of the oxides is of the greatest importance if efficient oxidation is to be effected. Manganese dioxide prepared according to Fremy's method, viz., by reduction of alkali permanganate with methyl alcohol, is active, but an active oxide can be prepared more easily by treating potassium permanganate with cold sulphuric acid, containing 3 per cent. of water. The most readily applicable method of producing active manganese dioxide is, however, the reaction between potassium permanganate, anhydrous manganous sulphate, and fairly concentrated sulphuric acid. Copper oxide was prepared by precipitating a cupric salt with caustic soda at about 70° C. The oxide of cobalt was most satisfactorily manufactured by precipitating cobaltous sulphate with sodium hydroxide in the presence of sodium hypochlorite.

"Hopcalite I" effects the catalytic oxidation of carbon monoxide in air at ordinary temperatures, especially in the absence of moisture, but at higher temperatures it is less sensitive to water vapour. The reaction is exothermic, and in the gas-mask designed, provision was made for countering excessive temperature-rise as well as for drying the inhaled air.

As an example of the efficiency of "Hopcalite," the following standard test was repeatedly passed. Ninety per cent. of the carbon monoxide was oxidised by a layer 5 cm. thick, when the gas mixture (0·25 per cent. carbon monoxide in air) was passed at the rate of 500 c.c. per minute per sq. cm. of the layer. Other mixtures of active oxides were made and thoroughly tested, but the mixture described above represented the most serviceable material, when cost and efficiency were considered.

SAFEGUARDING OF INDUSTRIES ACT.—Inquiries relating to this Act should be addressed to the Assistant Secretary, Board of Trade (Industries and Manufactures department), Great George Street, London, S.W. 1.

NEWS AND NOTES.

UNITED STATES.

Research on Nitrogen Fixation.—The sum of $500,000 has been made available for two years for the continuation of research work on fixed nitrogen. The Fixed Nitrogen Research Laboratory, at American University, Washington, with a staff of 120, has been transferred from the War Department to the Department of Agriculture (*cf.* J., 1921, 193 R.).

Rejection of the Embargo on Dyes.—In passing the Fordney Tariff Bill on July 21, the House of Representatives rejected, by 209 votes to 193, the provision for licensing imports of dyestuffs. The rejection is stated to have been due largely to the fear that a dye monopoly might be established. An attempt will probably be made to include the licensing provision when the Bill comes before the Senate.—(*Oil, Paint and Drug Rep., July* 25, 1921.)

Preservation of Desiccated Vegetables.—The researches of Gore and Mangels have shown that the moisture content of dehydrated raw vegetables is an important factor in their preservation when stored in airtight containers at ordinary temperatures. The critical moisture content below which the distinctive colour and taste are retained unimpaired for six months or more varies from 3·00—3·34 per cent. for cabbages to 5·74—6·64 per cent. for onions. Exposure to an atmosphere of comparatively high humidity at lower temperatures is more injurious than a similar exposure in a dry atmosphere.

Chromite in 1919.—Large stocks of chromite were left unsold at the time of the armistice, and sales in 1919 declined to 5079 tons, valued at $129,302, a decrease of 94 per cent. in quantity and 97 per cent. in value compared with 1918, although much in excess of sales in any pre-war year. California is by far the most important producer. Imports fell by 39 per cent. to 61,404 t., Cuba supplying 23, Australia 21, and Canada 14 per cent. Less chromite was imported from Canada, Brazil, and French Oceania, but more from new countries, viz., New Zealand, Spain, and Turkey in Asia.—(*U.S. Geol. Surv., Feb.* 4, 1921.)

Mercury in 1919.—The decline in the production of mercury in the United States made further progress in 1919, the output from 34 mines being only 21,415 flasks (of 75 lb.), valued at $1,933,560. This decline was due to decreased demand, low market price compared with cost of production, and the difficulty of finding ore of such grade and in such quantity to make continuous operation economically possible. Imports of mercury amounted to 10,635 flasks and exports to 9167 flasks. The appended figures show the world's production of mercury (in flasks) in 1917 and 1918:—

	1917.	1918.
United States	36,159	32,883
Austria	25,000*	17,637*
Hungary	2,500*	2,000
Italy	31,494	30,512
Spain	25,147	16,677
Mexico and other countries	4,000	4,000
Total	124,800	105,209

* Estimated.

IN 1917 the U.S. consumption of 26,360 flasks was distributed as follows (flasks):—Drugs and chemicals, 8500; fulminate, 4850; vermilion, 3130; oxide for anti-fouling marine paint, 3000; electric batteries, electrolysers, rectifiers, lamps, etc., 2700; felt manufacture, 1700; gold and silver amalgamating mills, 850; thermostats, gas-governors, automatic sprinklers, etc., 630; boiler compounds, cosmetics, etc., 1000. Mercury fulminate still remains the best-known and most-used detonator, but various substances such as lead azide, lead styphnate, hexamethylamino triperoxidediamine, nitrogen tetrasulphide, are considered likely to replace it entirely for certain purposes. Mercuric sulphate is used in the manufacture of phthalic anhydride, but a process has recently been devised by the Bureau of Chemistry in which the mercury salt is replaced by air, thereby reducing, it is said, the selling price to 45 cts. per lb.—(*U.S. Geol. Surv., Apr.* 5, 1921.)

FRANCE.

La Societe de Chimie Industrielle.—The annual meeting of this society will be held from October 9 to 12 in the Conservatoire National des Arts et Métiers, Paris. A full programme has been arranged, and many eminent specialists have promised to attend the numerous conferences, which will be organised into 34 groups corresponding to the various branches of industrial chemistry. On the evening of October 9 there will be a reception at which Monsieur Dior, Minister of Commerce, will preside, and the technical meetings will begin on the following morning at 9.30 a.m. M. Louch Eur, Minister of the Liberated Territories, will preside at the final session on October 11 at 5 p.m., and this will be followed by a banquet at the Palais d'Orsay, with M. Lefebvre de Prey, Minister of Agriculture, in the chair. October 12 will be devoted to visits to works. From October 7 to 16, a chemical exhibition will be held in the Conservatoire under the auspices of the Society; a large number of French firms will take part, and the exhibits will be confined to laboratory appliances, process control, and dyewares.

Industrial Notes. — *Chemical Industry.* — The recent drought will affect prices of many chemical commodities. The prices of sugar and alcohol are already rising owing to the poor state of the beet crop. There will be a shortage of starch owing to the failure of the potato crop; waxes and beeswax are already fetching very high prices, and the poor situation in the vegetable-oil industry will affect soap makers and producers of hardened fats.

The Compagnie Nationale de Matières Colorantes et de Produits Chimiques, which, it will be recalled, was formed in 1916 and amalgamated with the Société des Produits Chimiques et Colorantes Français at the end of 1919, is now making nearly 80 per cent. of the total production of dyes in France. The capital of this company—known as the "C.N.M.C."—is 71 million francs, and the net profit in 1920 was 12,675,633 fr. Its works are situated at Villers-Saint-Paul (Oise) and at Oisse (Seine-Inférieure). In addition to a number of research laboratories, controlled by one central laboratory, the company has established a department of "technical application" to act as a link between the works and the laboratories, and also a very efficient information bureau.

Metallurgy.—The demand for metallurgical products continues dull, and there is hardly any margin between cost and selling prices. To meet foreign competition steps are being taken to reduce costs, viz., the price of coke and transport charges, and to eliminate undue internal competition. The reconstruction of the factories in the devastated areas is progressing satisfactorily, but the work is now being taken over by private firms and conducted on more business-like lines. According to the latest census, the percentages of the works in the devastated areas which have restarted are as follows:—Nord 83·2, Pas de Calais 73·5, Somme 65·4, Aisne 53·9, Meurthe et Moselle 82·5, and Ardennes 80·6. Most of the Lorraine factories are fully equipped to produce for export, and the Société Normande de Métallurgie is following the same policy. This company exported 70,000 metric tons of iron and steel products in 1920, and will probably do even better in 1921; it intends to specialise in the production of railway material.

The Société Anonyme Forges et Aciéries du Nord et de l'Est has been founded with a capital of 46 million fr. for the purpose of amalgamating some 20 steel-producing firms with a view to cheapening production. The amalgamation is intended to unite the Lorraine steel industry with that of Northern France, thus giving the combine the control of the majority of the French steel works as well as of 350 million tons of iron ore, an entire series of coal mines, coke ovens, smelting works, cement, brick works, etc.

AUSTRALIA.

The Fertiliser Industry and Nauru Phosphate.—The manner in which the supplies of phosphate from Nauru Island will be divided among fertiliser manufacturers is evoking much interest; the companies that will be most affected are the Mount Lyell Co., in Tasmania, and the Australian Fertilisers Co., in New South Wales. Discussions are now taking place between the Electrolytic Zinc Co. of Australasia, Ltd., and superphosphate manufacturers with a view to utilising the sulphur produced in the roasting of zinc concentrates. At present the zinc company is not working at full capacity, and its plant will not be completed for some time, but when in full operation sufficient sulphur will be available to provide for two-thirds of the superphosphate requirements of the whole of Australia, thereby rendering unnecessary the importation of sulphur from America and Japan.—(*U.S. Com. Rep., July* 8, 1921.)

The Sugar Industry.—According to the Annual Report of the Bureau of Experiment Stations, Queensland, there has been a continuous improvement in the cane-sugar industry in the last 21 years. From 1898 to 1908 it required 9·20 tons of cane to make 1 t. of sugar, and the average yield in the field was 14·76 t.; during the period 1909—1918 the figures were 8·86 and 17·37, respectively, and in 1920 a ton of sugar was produced from 7·76 t. of cane. This improvement is ascribed to superior mill equipment and the cultivation of improved varieties of cane. Sugar-beet, which is grown solely in Victoria, is not in such a favourable position as the production is declining, despite the fact that the crop remains steady at about 12—13 t. per acre. In 1920 the output of the Maffra factory—the only beet-sugar factory—was 1551 t. of sugar, or an average of 1 t. of sugar to 9·09 t. of beet. The price paid for beets was 35s. per ton, and the factory made a net profit of £16,750, the by-products (pulp and molasses, etc.) being in strong demand. There will apparently be no increase in the acreage under sugar beet for next season, but it is expected that the present 1000 acres will be maintained. To the present 1000 acres will be maintained.

JAPAN.

Industrial Notes.—*Cement.*—The Japanese output of cement in 1921 will, it is estimated, amount to 11 million casks, which compares with 7,850,000 casks in 1920. The domestic demand up to April, 1921, was little different from that of the corresponding period of 1920, but exports declined by one-half and stocks were increasing. A conference of producers was held in May to discuss combines, fixing of prices, and restriction of output.

Porcelain.—The chief seat of this industry is in Seto-chow, although two or three of the largest works are situated in Nagoya. The producers are not hopeful of the future because, although there are enormous supplies of clay for making coarse ware, the deposits of "kibushi," the fireclay used for making hard porcelain and refractories, are almost exhausted. The privately-owned deposits of this clay having been depleted, the manufacturers have obtained permission to obtain it from the forest lands of the Prefecture of Aichi.

The Pyrethrum Industry.—Production and exportation of pyrethrum powder increased greatly during the war owing to the large consumption of insect powder in the trenches, but when the Dalmatian product reappeared on the market, exports declined (from 3217 long tons in 1919 to 1306 t. in 1920) and the price has fallen from 70—75 cents per lb. in March, 1920, to 20 cents in March, 1921. A further depreciation in price is anticipated, as there is a stock of 700 t. in Trieste. This amount, together with the forthcoming harvest of about 1500 t. will make the available supplies greater than the world's demands.

Paper.—In 1920 the production of paper by the members of the Association of Japanese Paper-mill Owners was 252,645 long tons, of which about 45 per cent. was newsprint and about 30 per cent. high-grade and ordinary printing paper. Exports were valued at £2,360,167 (yen=2s. 0½d.) and imports at £1,776,250, values which were 11 and 6 per cent., respectively lower than in 1919.

The Coal Industry.—The Japanese Bureau of Mines estimates the coal deposits of the country at 8,792 million metric tons, of which 822 million t. has been developed and 2940 million t. surveyed. At least one-fourth of the total reserves is said to be recoverable by present-day methods, so that the net available coal resources of Japan can be placed at 2995 million t. This figure does not include the resources of North Formosa, estimated at 461,200,000 t. net, or the Fushun mines in South Manchuria (owned and operated by the Japanese South Manchuria Railway), where the resources are placed at 1000 million metric tons.—(*U.S. Com. Rep., June* 31, 14, 7, 16, 4, *resp.*, 1921.)

BRITISH INDIA.

Industries of the Baroda State.—The following notes are abstracted from the Annual Report of the Department of Commerce and Industry for the year 1919—1920, which was one of the most important in the history of Baroda industries. All the well-established factories did well and were extended, *e.g.*, the Dwarka Cement Works, originally designed to turn out 60,000 tons of cement annually, is now to have its output capacity doubled. New industries promoted during the year include 10 cotton mills, 1 woollen mill, and 3 oil mills; concessions were granted for alkali and salt works at Dwarka and Kodinar; a factory to manufacture sulphuric and other acids was started at Baroda; a tanning factory was organised at Kalol, and a dyeing factory at Baroda.

Among the industries investigated by the Department during the year may be mentioned:—*Wood distillation.*—As a result of the investigation on the woods found in the State forests, a syndicate has undertaken the distillation of wood, and a site in the Vajapur forests suitable for a factory has been selected and approved. *Tannin materials.*—The tannin materials found in the State forests were collected, and those on which sufficient work had not been done in India were sent to experts in England to test their tanning values and the possibility of making extracts from them. *Casein and lactose.*—Statistics regarding the number of milk separators in the State, the quantity of milk churned and the use to which the separated milk is put, etc. were collected. A full report of the method of making casein and of the casein industry was prepared and sent to an expert in England for advice with the object of putting the industry on a right basis and of selecting the best method of manufacturing casein and lactose. Casein was manufactured locally from separated milk by spontaneous lactic fermentation and converted into glue for use in the manufacture of glass-papers. The animal glue used in imported glass-papers loses its power of keeping the glass particles attached to the paper in the rainy season, and thus becomes useless as a smoothening agent. The casein adhesive tried was not affected by moisture, and promises to be more suitable to Indian conditions. The experiments are to be continued. *Glass.*—An exhaustive report on the Baroda glass factory, showing the methods of glass-manufacture practised, raw materials used and their cost, kinds of furnaces used, output, cost of manufacture, etc. was prepared. Samples of sand and sandstone suitable for glass manufacture found in the State were sent to experts in England for analysis and report. If the report is encouraging, the improvement of the local glass factory and the possibility of starting an up-to-date factory for the manufacture of high-grade glass will be considered. *Alkali lands.*—Soda lands in various localities were inspected, but the results were not encouraging, as there is not sufficient crude soda to start a factory for the manufacture of pure soda. *Ceramic survey.*—There are large undeveloped resources of varieties of clay, earth, and stone, and the advice of the ceramic expert appointed by the State is likely to be invaluable to the glass manufacturers and to the trade in pottery. During the past three years several tile works have been started, and in the year under review the erection of several pottery works was planned.

GENERAL.

"Coal, Coke, and By-products, 1913-1919. Pt. I."—This, the latest pamphlet issued by the Imperial Mineral Resources Bureau (pp. 124, price 3s. 6d.), contains general information concerning peat, coal, coke, and by-products, much of which is well known. Its chief value lies in the details of the world's production of coal and in the exhaustive statistics relating to the United Kingdom. Statistics in respect of the Empire other than the United Kingdom, and Foreign Countries will be issued later. The world's production of coal in 1919 was about 1130 million tons, or 190 million tons less than in 1913; the British Empire contributed 25·4 per cent. of this quantity. Factors affecting the world's coal markets at present are the reduced production in Europe, the re-partition of territory brought about by the war, the development of production within countries dependent upon imports, and the changes in the American export trade.

The coal statistics relative to the United Kingdom are introduced by a review of the various factors which influenced production, export and prices of various grades of coal during the war period, and by a list of colliery sinkings started, in progress, or completed during 1919. In addition to details of coal production, prices, and exports, similar figures are given for coke and briquettes. The statistics include the market prices of the chief materials and details of the production and export of ammonium sulphate, products other than dyes, and of coal-tar dye-products.

Nitrogen Fixation in Italy.—It is announced that the capacity of the Idros factory of the Società S.A.R. at Terni has been increased to over one metric ton of ammonia every 24 hours. The process used at the Terni factory is that of Dr. L. Casale (E.P. 148,885, 1920), and consists in producing a mixture of hydrogen and nitrogen by burning air in an atmosphere of electrolytic hydrogen, the mixture afterwards being heated to 350°—600° C. in the presence of a special catalyst. In the *Giornale di Chimica Industriale ed Applicata* of June, 1921, it is stated by an engineer that nitrogen produced by this process will always cost from 2·5 to 4·7 times more than that produced by the Claude process, and that therefore the former is unsuitable for use on a large scale.

It is reported that the Società S.A.R. is to change its name to the Società Italiana Ammoniaca Sintetica Processo Casale, and to raise its capital from 6,030,000 lire to 23 million lire.

A company, the "Nitramonia," has recently been formed in Milan with a capital of 1 million lire to produce synthetic ammonia by the Claude process.—(*G. Chim. Ind. ed App., May, June*, 1921; *Oil, Paint and Drug Rep., July* 18, 1921.)

Discovery of Kaolin in Finland.—Deposits of kaolin have been found in the Puolanka and adjacent parishes of Oesterbotten, Finland, and a company has been formed to investigate them; should results be successful, it is proposed to form a larger company with a capital of 6 million marks (Finnish mk.=10¾d. at par, now 1d.) to work them. As the deposits are partly located on State lands, the Government will probably be asked to provide one-third of the capital.—(*U.S. Com. Rep., June* 7, 1921.)

Chemical Industry in Finland.—The chemical industry of Finland has developed very satisfactorily but many of the numerous factories which have recently sprung up are likely to disappear, for the country lacks both the geographical position and the necessary raw materials for the development of a large export trade. It is also considered probable that the home trade will suffer when the present *régime* of import licences is abandoned. Quite recently the manufacture of gelatin has been successfully established, and this product is now being exported by the Aströms factories.—(*Chem. Ind., June* 13, 1921.)

The Orkla Pyrites Mine in Norway.—This pyrites mine, the largest in Norway, has recently ceased operations. The chief shareholders are Swedes, and the net profits and dividends in 1917, 1918, 1919 were 3·5, 4·0, 4·9 million kroner and 10%, 15%, 15%, respectively, the capital being 20 million kr. (krone=1s. 1½d.). In the good years considerable sums were spent on plant and development, but lately retrenchment has been the rule. Prospects for the immediate future depend entirely upon whether the undertaking can deliver pyrites under existing contracts, a question which depends upon the rate of exchange with Germany. At the moment the pyrites market is extremely quiet and prices offered are lower than ever before. The Orkla deposits are particularly rich and working costs are low.—(*Chem. Ind., June* 20, 1921.)

The Sulphuric-Acid Industry in Denmark.—The Danish Sulphuric-Acid and Superphosphate Factory made a loss of 17·2 million kroner (£967,500 at par) during its last financial year. The company's report states that in view of the anticipated great demand for superphosphate in Denmark after the war the company ordered sufficient raw materials to keep all its own and affiliated factories working at full capacity until well into 1921. In consequence, however, of the high prices of superphosphate in Denmark, and of the persistent reduction in the prices of agricultural products, the farmers generally restricted their consumption of artificial fertilisers, and in addition some of the largest consumers preferred to purchase superphosphate from abroad, in spite of the fact that the Danish factories were able to deliver at competitive prices.—(*Chem. Ind., June* 27, 1921.)

Chemical Industry in Sweden.—According to an official report the production of pure chemical drugs in Sweden has recently fallen off and that of salicylic acid and phenol has been discontinued. The industry is agitating for State help in the form of protective duties. Normally, the annual consumption of chemical drugs is of the value of 7 million kronor (nearly £400,000 at par). The superphosphate industry has suffered from a shortage of raw material since the beginning of 1920; prices have fallen by about 10s. per ton, owing to reduced transport charges, but sales are much smaller than before the war, and competition has recently been felt from Holland, Germany, and Belgium. Sales of ammonium sulphate have been extraordinarily small during the past 12 months, and in the last few months German sulphate has appeared on the home market. Production in the explosives industry has been nearly at a standstill and sales of sulphite spirit have latterly fallen off.—(*Chem. Ind., June* 13, 1921.)

The Iron-Ore Deposits of Lappland.—The Swedish Government is to give every facility for the exploitation of the iron-ore deposits in the vicinity of Kiruns, in Lappland. The deposits are estimated to contain 35 to 40 million tons of ore; a railway has been built to connect them with Kiruns, and the daily production is now about 100,000 tons.—(*Met. u. Erz, July* 22, 1921.)

The Paper Industry in Latvia.—The output of the five chief paper mills in Latvia prior to the war was 27,468 long tons of paper, including 21,774 tons of best and medium-grade paper, of which 85 per cent. was exported to Russia and Poland. The most important mills were at Ligat and Sloka, the former making writing and drawing paper from rags and the latter stained paper for albums, envelopes, etc. Both mills suffered during the war, but reconstruction is in progress and it is anticipated that the Sloka mill will soon restart operations, thereby obviating the need for importing cellulose from Finland, Esthonia, and Germany. There is a large mill, owned by E. Bruhns and Co., on Lake Jugla, and brown wrapping paper is made at Staizele and Litene; the Staizele mill alone can supply the Latvian requirements for wrapping paper (about 4000 t.), and at Litene about 1613 t. of mechanical wood pulp can be produced and made into printing paper. The entire paper consumption of Latvia amounts to about 6613 t. per annum, and if further wood-pulp machinery were installed, the country would be able to export in large quantities.—(*U.S Com. Rep., May* 10, 1921.)

Leucite as a Fertiliser in Italy.—Leucite (a double silicate of potassium and aluminium, is being mined for use as a fertiliser from a deposit covering about 3 sq. km. near Civita Castellana, in the province of Rome. The mineral contains 21·5 per cent. of potash (K_2O) and is now used extensively in Italian agriculture. It is stated to have given excellent results with rice, potatoes, sugar-beet, tobacco, rye, oats, and barley, and it has also been used in the reclamation of acid soils.—(*U.S. Com, Rep., June* 1, 1921.)

The Match Industry in Yugoslavia.—There are six match factories in Yugoslavia, of which five are now producing. These are situated at Osjek, Baja, Novo, Vrbas, Verbovsko, and Dolac, near Travnik, and are producing daily a total of 720,000 boxes, each containing 60 "Swedish" matches. The factory in Sus (Slovenia) is making 60,000 boxes of sulphur matches daily. Production suffices to cover the country's requirements. Before the war the wood was obtained from Siberia, but now wood from the Canadian poplar, which flourishes in Baranya and Bosnia, is used.—(*Chem. Ind., June* 27, 1921.)

The Cork Industry in Spain.—The cork industry plays an important part in the commerce of Spain, the output in 1919 attaining 80,000 metric tons. Catalonia, Andalusia, and Estremadura are the chief centres of the industry; fine cork is mainly produced, inferior qualities being imported from Algiers, Morocco, and particularly Portugal. The export in 1919 was 42,000 t., worth, roughly, 39 million pesetas (peseta=9½d. at par, now 8½d.), and consisted chiefly of manufactured or semi-manufactured cork. Cork dust is used extensively for packing fruit and in the manufacture of briquettes.—(*U.S. Com. Rep., May* 27, 1921.)

Technical Publications in Germany.—There are now 6400 technical and official publications in Germany, compared with 6250 before the war. From 1890 to 1900 about 120—130 new publications appeared every year, and about 200—230 each year from 1900 to 1914. Since 1890, however, 840 technical journals have been established, and during the war over 1900 suspended publication, so that only 4300 remained at the end of 1918.—(*Chem.-Z., June* 16, 1921.)

Glucinum.—This element has recently been prepared in a compact form and in a pure state by Prof. A. Stock, of Dahlem, assisted by Drs. Praetorius and Priess; the details of the electrothermic method employed by them will be published later. Hitherto this metal—which melts at about 1300° C.—has only been obtained in the form of fine spangles which were subsequently melted with much difficulty. The atomic weight of glucinum has recently been found by Prof. O. Hönigschmid in Munich to be 9·017, which is 1 per cent. lower than previous determinations.—(*Edel-Erden und Erze, June* 30, 1921.)

Chemical Industry in Soviet Russia.—Since all the factories in Russia were nationalised, 85 chemical works have been put under chemical management, and of these the works situated in the south and in the Urals, which were only taken over towards the end of 1920, had suffered severely during the civil war. Recently, 22 factories in the Caucasus have been put under chemical control. The following table summarises the production during 1920, the number of factories being given in parenthesis:—

	Intended production.	Actual production.	Per cent.
	Metric tons.		
Sulphuric acid (7)	24,037·0	14,156·9	63·6
Oil (3)	8,790·3	5,568·0	67
Nitric acid (8)	1,302·7	408·8	31·3
Sulphates (?)	19,397·9	6,639·1	80·6
Chlorides (?)	1,744·0	326·3	18·7
Carbonates (1)	5,769·0	12,331·3	131·6
Chromium salts (2)	1,767·6	1,230·5	63·6
Bleaching powder (1)	4,329·5	3,318·8	76·0
Sodium sulphate (4)	1,489·5	882·9	50·2
Other salts	2,432·3	947·9	28·3
Superphosphate (4)	18,279·0	6,293·4	34·0

The poor results were due to lack of raw materials, fuel, competent workers, and to bad management. Practically no work was done at the factories in South Russia and the Urals, although now the latter have become more active. Production of petroleum in the Baku district has greatly fallen off; whereas the pre-war monthly output was 36–38 million poods, in December last it was 12 millions, in January 10 millions, and in February only 8 millions.—(*Chem. Ind., June* 20, 1921.)

Sulphur Deposits in Argentina.—Industries that utilise sulphur as a raw material, *e.g.*, sulphuric acid and carbon bisulphide, have been established in Argentina for some time past, but the sulphur required has always been imported as the deposits that were known to exist in the country were not worked owing to lack of transport and other difficulties. The war, however, necessitated the development of home resources, and investigations showed the existence of sufficient sulphur not only for local requirements, but for exportation on a large scale. Although most of the deposits are too poor to exploit, others contain extremely pure sulphur, *e.g.*, the sulphur in the Neuquen district, between Conuevo and Las Lajas, is practically 100 per cent. pure. Other deposits occur in the province of Mendoza, at Overo and Petarva, both extinct volcanoes, and in San Juan, where it is associated with gypsum. The richest and most promising deposits, however, occur in the Andes, but only partly on Argentine soil. The deposit at the Tucley volcano, which was the first to be exploited, is inexhaustible, but exploitation is rendered difficult by lack of water and coal and the necessity of working at an altitude of 13,000 ft. The cost of production at present is about 6 peso (paper) per ton of rock containing about 33 per cent. of sulphur, but owing to heavy freight charges, the price in Buenos Ayres is 158 peso (peso=1s. 8¾d. at par). Should, however, the projected Trans-Andean railway be constructed, it will become possible to open up the Tucley deposit and to produce sulphur that can compete with the imported product.—(*Chem.-Z., June* 9, 1921.)

PERSONALIA.

Prof. Henry Le Chatelier has been presented with a gold medal on the occasion of his scientific jubilee.

Sir William Alexander has succeeded Sir Henry Birchenough as chairman of British Dyestuffs Corporation, Ltd.

Prof. Guiseppe Tommasi has been nominated director of the Royal Station for Agricultural Chemistry at Rome.

Prof. Henry Louis has been appointed hon. secretary of the North of England Institute of Mining and Mechanical Engineers.

Mr. H. P. Philpot, assistant-professor at University College, has been appointed to the professorship of civil and mechanical engineering at the Finsbury Technical College.

A party of representative French and foreign chemists, led by Prof. Haller, recently visited the birthplace of Gerhardt at Strasbourg, and Prof. Tiffeneau, of Paris, delivered a memorial discourse at his grave.

The Lindbom Prize of the Academy of Sciences, of Stockholm, has been divided equally between Prof. Sven Odén for a thesis "On Precipitation" and C. Lönnqvist for a paper on the temperature of the interior of the earth. Prof. H. von Euler, of Stockholm, has been awarded the Letterstedt author's prize for his work on "The Chemistry of Enzymes. I."

The following appointments are announced from the United States:—Dr. H. F. Lewis, of the National Aniline and Chemical Co. of Buffalo, to be associate professor of chemistry at Cornell College, Iowa. Dr. J. D. Rue, formerly professor of industrial chemistry in the University of Michigan, to be head of the pulp and paper department, Forest Products Laboratory, Madison, Wis. Dr. J. H. Shrader, of the Department of Agriculture, has been appointed director of the Bureau of Chemistry and Food, Health Department, Baltimore, Maryland, and Mr. W. J. Crook, chief metallurgist to the Pacific Coast Steel Co., to be professor of metallurgy in Stanford University. Wilfred W. Scott, research chemist to the General Chemical Co., and author of "Standard Methods of Chemical Analysis," has been appointed associate professor of chemistry in the Colorado School of Mines.

Prof. H. Wichelhaus has retired from the chair of chemical technology in the University of Berlin.

Prof. D. Schmiedeberg, formerly professor and director of the Pharmacological Institute in the University of Strasbourg, died recently in his 83rd year. The deceased was well known for his work on digitalis.

Prof. Edward Hjelt, professor of organic chemistry in the University of Helsingfors, and at one time Finnish Ambassador at Berlin, died on July 2 at the age of 66 years. Hjelt was the author of many papers on the higher fatty acids, on lactones, coumarin, turpentine, etc.; in recent years he devoted much attention to the history of chemistry.

PARLIAMENTARY NEWS.

HOUSE OF COMMONS.

British Industries Fair.

Answering Mr. Gilbert, Sir P. Lloyd-Greame said that negotiations were in progress for holding the British Industries Fair of 1922 at the White City. There was a good prospect of eventually obtaining permanent accommodation for the Fair in the exhibition buildings which were to be erected for the British Empire Exhibition in Wembly Park. —(Aug. 8.)

Coal Production.

In reply to questions addressed to the President of the Board of Trade it was stated that the output of coal in the first three weeks after the resumption of work was 2,352,700, 3,935,200, and 4,331,800 tons, respectively (5,404,400 t. in June, 1914). Higher figures could be reached when normal working conditions returned, but output depended also upon market conditions. The output of coal in Europe in 1913 and 1920 amounted to 596,000,000 and 448,000,000 tons, respectively, the chief producers being:—

	1913.	1920.
	Long Tons.	
United Kingdom	287,430,000 ..	222,532,000
Germany	188,433,000 ..	129,236,000
France	40,187,000 ..	34,153,000*
Russia	33,206,000 ..	5,850,000
Belgium	22,474,000 ..	22,053,000
Austria	16,195,000 ..	132,000

* Inclusive of the output of the Saar and Lorraine, 12,383,000 t.

The export of coal from the United States to Europe was 476,000 t. in 1913 and 11,800,000 t. in the year ended May last.—(Aug. 8, 10.)

Surplus Government Iron Ore.

Mr. Young, in answer to Mr. Mills, said that in 1917 the British Government purchased 1 million tons of Swedish iron ore, of which 165,000 t., some of which was sold, still remained at Norvik. The total storage charges amounted to £10,000, but no further expenditure on storage was anticipated.—(Aug. 8.)

Production of Pig Iron.

Mr. Baldwin informed Mr. Hurd that the output of iron and steel by the chief producing countries in 1920 was:—

	Pig Iron.	Steel.
	Long Tons.	
United Kingdom ..	8,008,000 ..	9,057,000
United States	36,403,000 ..	40,773,000
Germany (approx.) ..	7,000,000 ..	9,000,000

The reported production in France, Belgium, Sweden, Spain, Italy, Canada, India, and Japan represented a total of about 7 million t. of steel and slightly less than that amount of pig iron.—(Aug. 8.)

"Slag Phosphate."

Sir A. Boscawen, in reply to Lieut.-Com. Kenworthy and Mr. Forrest, said that the technical advisers of the Ministry of Agriculture were satisfied that although the Nauru phosphate that formed part of the "slag phosphate" fertiliser sold by Messrs. Sinclair and Co., Ltd. could not properly be described as guano, it had originated from guano, and could accurately be described as "phosphate of guano origin." No exception therefore could be taken to the statement that "slag phosphate" was made from basic slag enriched by phosphate of guano origin from Ocean and Nauru Islands. He was not aware that field trials had been made to compare Nauru phosphate with other mineral phosphates, but a ground mineral phosphate was being sold at about 2s. per unit of phosphate of lime as compared with 3s. per unit for "slag phosphate (*cf.* J., 1921, 278 R). The Slag Phosphate Co., Ltd. was the only firm prepared to undertake the immediate distribution of Nauru phosphate in satisfactory quantities.—(Aug. 8, 15.)

Safeguarding of Industries Bill.

The discussion of this Bill was resumed on August 10, and on August 12 it was read a third time. Attempts were made to exempt goods used for educational or scientific purposes and also optical glass and optical instruments, but without success. In spite of the fact that the Speaker certified the Bill to be a Money Bill within the meaning of the Parliament Act, two amendments were introduced into it in the House of Lords, but the Commons having disagreed, these were not persisted in, and the Bill was passed.

Australian Import Duties on British Perfumes.

Sir W. Mitchell-Thomson. answering Major Kelly, said that he was aware of the order issued by the Australian Customs Authorities whereby perfumes manufactured in Great Britain for export in bond would be assessed for the Australian import duty on the basis of their export catalogue prices, whereas British perfumes made in free factories from spirit on which excise duty had been paid and drawback subsequently obtained would pay duty in Australia based on the full home consumption values, no deduction for duty on drawback being allowed. The Federal Customs Authorities had been approached on the matter, and the amendment of the Regulation was being considered.—(Aug. 10.)

Ironhirst Peat Factory.

Answering Major Kelly, Mr. H. Young said that the total expenditure by the War Office and the Ministry of Munitions on the Ironhirst Peat Factory was approximately £490,000, and that Wetcarbonising, Ltd. had agreed to purchase the factory for £370,000 (*cf.* J., 1921, 15 R). The company, however, had failed to find the purchase money and the agreement was cancelled. Negotiations for the sale of the factory had recently been concluded, and in view of the small dividend anticipated, it was deemed expedient to waive all claims against the liquidator in return for a complete release of certain claims by the company against the Government.—(Aug. 12.)

Dyestuffs Development Committee.

Capt. Elliott asked the President of the Board of Trade if any representatives of associations of chemical technologists had been appointed to the Dyestuffs Development Committee (*cf.* J., 1921, 252 R); and if not, if a representative of the British Association of Chemists could be appointed on behalf of the dye-making and dye-using industries? In reply, Sir P. Lloyd-Greame said that the President had not seen his way to make any appointments from individual technological associations.—(Aug. 15.)

The Alkali Industry.

Sir W. Mitchell-Thomson, answering Mr. A. Davies, said that he understood there was an agreement in the alkali industry between Brunner, Mond and Co., Ltd. and the United Alkali Co., Ltd. with the object of regulating prices and sales of certain products, but he was informed that the agreement did not limit output or extend to labour conditions. —(Aug. 19.)

* * *

Upon the adjournment of the House until October 18, the Royal Assent was reported to the Safeguarding of Industries Act, 1921, and to the Railways Act, 1921.

OFFICIAL TRADE INTELLIGENCE.

(*From the Board of Trade Journal for August* 11 *and* 18.)

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W. 1, from firms, agents or individuals who desire to represent U.K. manufacturers or exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department and quoting the specific reference number.

Locality of Firm or Agent.	Materials.	Reference Number.
Australia ..	Lubricating oils, asbestos sheets, colours for coaches	120
„ ..	Pottery, glassware	121
Australia and New Zealand	Aluminium sheet, leather, leather cloth, celluloid and casein sheet ..	123
Canada ..	Lubricants, oils, chemicals, bottles, glassware, glues, household dyes	124
„	Chinaware	6441/E.D./S.C.2
New Zealand	China, glassware	128
„ „	Milk bottles	6435/E.D./S.C.2
South Africa ..	Tungsten-filament train lamps (tender for)	6495/E.D./P.N.
Czechoslovakia	Anti-friction metals	160
Denmark ..	Iron and steel rolling-mill products	161
Italy ..	Pharmaceutical products	133
Spain ..	Metals	167
Far East ..	Soap, perfumes, dyes, paint, varnish, disinfectants, fertilisers, glassware, cement	169
United States	Gums (arabic, tragacanth, myrrh, olibanum)	138
Argentina ..	Chemicals	140
„	Glassware	143
Chile ..	Copper, brass, steel, cement, coal	146

Market Sought.—A Canadian company able to export sheet and ground mica invites inquiries from importers in the U.K. [Inquiries to the Canadian Government Trade Commissioner, 73, Basinghall Street, London, E.C. 2.]

TARIFF. CUSTOMS. EXCISE.

Antigua.—A copy of the new Customs Tariff Ordnance may be seen at the Department.

Austria.—Increased import duties are payable on, *inter alia*, cocoa, vanilla, saffron, sugar, molasses, distilled spirits, coal-tar oil, mineral oils, paraffin wax, and perfumery.

Barbados.—The Customs Tariff Act, 1921, which came into force on July 1, gives effect to the provisions of the Canada-West Indies Trade Agreement. A copy may be seen at the Department.

Czechoslovakia.—As from June 1 the tariff rates are multiplied by "coefficients of increase" which vary from 1 to 16 according to the class of goods. New duties or increases in the existing rates are applicable to malt, certain oilseeds, margarine, orchil, dyeing extracts, certain kinds of pitch, crude oil for lubricants, fireproof magnesite and bauxite bricks, raw lead and zinc, slabs of common metals (except iron), nickel anodes, starch, etc.

East African Dependencies.—Increased import duties affect perfumery, sugar, chemicals, petroleum, paint, soap, and turpentine.

Egypt.—A consumption duty of 2 per cent. *ad valorem* has been levied on certain vegetable oils, mineral lubricants, turpentine, ammonia, hydrochloric, nitric and sulphuric acids, gelatin, sheet lead and zinc, glass, pitch, and asphalt.

Finland.—Revised export duties affect charcoal, wood pulp, paper, bones, hoofs, horns, hides, skins, cast iron, tar, pitch, rosin, turpentine, methyl alcohol, and matches.

French Oceania.—The import duty on sugar is fixed at 25 fr. per 100 kg. for raw sugar and 26 fr. per 100 kg. for refined sugar.

Germany.—Certain dyewoods and dyeing plants may now be imported without licence.

The export is permitted without licence of thickened sulphite lyes, hard rubber, wire, and certain wares of copper, iron, nickel and tin.

Germany (Occupied Territory).—A copy of a list of goods that may be imported without licence may be seen at the Department.

Hungary.—Articles for which import licences must be obtained as from July 13 include grease, certain vegetable oils, refined colouring earths, certain kinds of rubber wares, nickel anodes, sheets of common metals (except iron), solder, potash, glycerin, glue, lac varnish, candles, and prepared blacks.

Luxemburg.—Thomas slag may be exported without licence as from July 21.

Martinique.—The import duty rates on perfumery and plate glass have been doubled.

Mexico.—As from August 1 import duties have been re-imposed on crude mineral oil and sulphuric acid.

New Caledonia.—Export duties have been re-imposed on raw hides and skins, copra, and trocas.

Norway.—Export prohibitions have been removed from bones, cellulose pulp, cyanamide, nitrate of lime, paper, cardboard, and superphosphates.

Rumania.—Among the articles exempted from export taxes are sand, sulphuric and acetic ethers, amyl alcohol and acetate, crude sulphuric acid, glucose, and sodium carbonate.

St. Vincent.—Groundnuts now pay an export duty of 8d. per cwt.

Serb-Croat-Slovene State.—The new Customs Tariff came into force on July 16. The rates of duty are greatly increased and are payable in gold. Particulars for the various classes of goods may be obtained on application to the Department. The 10 per cent. *ad valorem* tax on "articles of luxury" still remains in force.

South Africa.—A refund of the whole or part of the import duty may be allowed on certain substances used in the manufacture of rubber, viz., zinc white, zinc sulphide, antimony sulphide, alumina, magnesium carbonate, calcined magnesia, lithopone, vegetable black, carbon black, Prussian blue, white lead, "Emarex," vulcanised vegetable oils, aniline oil, rosin oil, vaseline, benzol, coal tar, naphtha, "Westrosol," "Westron," carbon bisulphide, and sulphur dichloride.

Zanzibar Protectorate.—The import of condensed skimmed milk containing less than 9 per cent. of milk fat is prohibited as from June 14.

GOVERNMENT ORDERS AND NOTICES.

Termination of War with Hungary.—By an Order in Council of August 10, July 26, 1921, is to be taken as the date of the termination of war with Hungary. A further Order in Council made on the same date gives effect to certain provisions of the Treaty of Peace with Hungary, including the regulation of rights in industrial property acquired before or during the war.

Importation of Soy.—The Board of Customs and Excise announces that consignments of soy imported on and after September 1 will be charged with duty as molasses at the rate appropriate to the percentage of sweetening matter contained in the article. The heading in the Customs and Excise Tariff—"Soy, when containing molasses or other sweetening matter"—will be cancelled.

REPORTS.

Report on the Trade and Commerce of Ecuador, Dated February, 1921. *By* W. C. Graham, *Acting Consul-General, H.M. Legation, Quito. Department of Overseas Trade. Pp.* 27. *London: H.M. Stationery Office.* 1921. *Price 9d. net.*

The financial position of Ecuador is very unsatisfactory, and prospects of improvement appear remote. Production of cocoa, the staple product, has declined owing to greatly increased cultivation in other countries, and concomitantly the revenue has suffered from the virtual cessation of exports. Other agricultural products upon the export of which the country is dependent are ivory nuts, rubber, coffee, tobacco, cinchona bark, and hat straw; sugar, rice, cotton, aloes fibre, food-crops and timbers are cultivated but not exported. Agriculture is practised on very primitive lines, but some effort is being made to introduce science into the cultivation of cacao. The agricultural possibilities of the country are enormous and only need capital, enterprise and better transport. Little is known of the mineral resources; coal, manganese, quicksilver, petroleum and sulphur are stated to exist, but practically no development work has been done. An American company is working gold at Zaruma, and four British companies are prospecting for petroleum on the Gulf of Guayaquil. So far their operations have been unsuccessful, and except for the evidence afforded by numerous surface wells, of which the production is declining, there is nothing to justify belief in a future oil industry.

Trade has been stagnant, as there are large stocks of goods which were ordered before the slump in prices took place. Exports in 1919 were valued at £4,322,055 (£1=10 sucres), and included (metric tons), cocoa 44,680, ivory nuts 25,504 t., coffee 1692 t., cotton 604 t., and rubber 402 t. The import trade in the same year was valued at £2,400,769, and included drugs and chemicals worth £136,820, cement, etc., £23,199, paints, varnishes, enamels £29,205. Of the total foreign trade, the United States took 46 per cent. of the exports and supplied 70 per cent. of the imports, as compared with the British shares of 17 and 14 per cent. respectively. Although in the past the United States has had the lion's share of the foreign trade, British goods are growing in favour as they are held to be superior, and there is a growing desire to become independent of the United States.

General Report on the Economic Situation in Switzerland, Dated April, 1921. *By* J. R. Cahill, *Commercial Counsellor, H.M. Embassy, Paris, late of H.M. Legation, Berne. Department of Overseas Trade. Pp.* 64. *London: H.M. Stationery Office.* 1921. *Price 1s. 9d. net.*

Coal has long been worked in Switzerland, but prior to 1914 there was little incentive to production as Germany supplied about five-sixths of the requirements at moderate prices. Owing, however, to the difficulty of obtaining supplies production in 1916 rose to 41,500 tons of anthracite (from the Canton of Valais), and 68,291 t. of schist coal, of which seven-eighths came from the Gondiswil-Zell mine, as against a pre-war average of 30,000—40,000 t. No returns of output are available for 1919 and 1920. The Schweizerische Kohlen-Bohr Gesellschaft, aided by the Government, has been investigating the coal deposits at Buix, in Elsgau, and the Chandolin anthracite mines in Sion, recently amalgamated with another undertaking in Sion, has raised its capital to 1·5 million fr. Production of peat increased during the period of fuel shortage, but declined as soon as coal became more plentiful.

Exploration of the extensive deposits of oolitic iron ore in the Frick Valley (*cf.* J., 1920, 185 R, 360 R) has disclosed the presence of more than 15 million tons of ore over an area of 470 acres, a quantity which would meet the country's requirements for 45 years. A company is being formed to exploit these deposits, and the Government is expected to put up some of the capital. Other mineral deposits receiving attention are quartz, gypsum, magnesite, molybdenum ore, asbestos, and fluorspar. Soda is made from salt found near the Rhine, and the important deposits of asphalt in the Val de Travers are worked by two English companies. A concession for the exploitation of oilsands in the Canton of Geneva has been taken over by an Anglo-Swiss undertaking; the area is about 12,000 acres and a plant is being erected to treat 200 tons of the bituminous sandstone daily, the yield of oil being estimated at 20 galls. per ton. Water-power resources are being actively developed, and at the present time about 26 per cent. of the total is being utilised.

Switzerland was not seriously affected by the trade crisis until the end of 1920, but the collapse of foreign exchanges has seriously impeded the export trade. Imports and exports in 1920 were valued at 4,242,721,000 fr. and 3,277,104,000 fr., respectively. Imports were supplied mainly by the United States (20%), Germany (19%), France (14%), and the United Kingdom (11%), and the exports were sent chiefly to the United Kingdom (20%), France (16%), the United States (9%), and Germany (8%). All the great Swiss manufacturing industries have adapted themselves to the changed conditions, exports of textiles and chemicals to the United Kingdom have increased, and new markets have been found to replace old (*cf.* J., 1921, 154 R).

General Report on the Trade and Economic Conditions of Turkey, Dated January, 1921. *By* Capt. C. H. Courthorpe-Munroe, *Commercial Secretary to the British High Commissioner, Constantinople. Department of Overseas Trade. Pp.* 75. *London: H.M. Stationery Office.* 1921. *Price 2s. net.*

The economic condition of Turkey during 1920 was most serious and at the date of the Report the Government was bankrupt, the currency depreciating almost daily and the general outlook very black. Production was at a low ebb and foreign trade, especially exports, stagnant. Except for the raising of coal and lignite in one or two areas, mining has practically ceased owing to the political conditions. Of the agricultural industries, the production of olive oil was the most satisfactory, the quality and yield being good; it is estimated that about 22,000 metric tons of oil was available for export at the port of Smyrna. There are hundreds of small factories making olive-oil soap in Syria and other parts where olive trees abound; this industry has suffered relatively very little, although lately prices have been considerably reduced. Large stocks of valonia are stored at Smyrna, and big shipments have been made to the United Kingdom and America since May, 1919. Owing to political unrest fewer gall nuts are being collected, the crop during 1919 being about 350 metric tons, compared with a normal crop of 400—500 tons. There is a good foreign demand for light skins, of which 3—4 million pieces are now produced annually (one-half of the pre-war quantity). The opium trade has suffered greatly from export restrictions in England and the United States; other European countries are now developing into distributing centres. Sugar-beet cultivation, started during the war, has apparently been suspended, but the authorities predict a great future for this industry. Several small British firms started business in Turkey during

1920, one of which supplies pasteurised milk which has undergone the test prescribed by the British Army medical authority. In June a group of Russian capitalists applied to the Ottoman Government for a concession to put up in the Kara Agatch Municipal Slaughter House a factory for the production of albumin from the blood of slaughtered cattle, and for curing the guts of the same animals.

The United Kingdom maintains its position in the Turkish import trade, but keen competition is being felt from the United States, especially in soda ash, coal, fats and greases, etc., and to a lesser extent from Italy. Trade has not yet been resumed with Germany and Austria, but German wares, especially electrical goods, are being imported through neutral nations (*cf.* J., 1920, 442 R).

Second Report of the Departmental Committee on Lighting in Factories and Workshops. *Pp.* 12. *H.M. Stationery Office*, 1921. [*Cmd.* 1418.] *Price* 1d.

The first report of the Departmental Committee was issued in 1915, and further inquiry was postponed until after the war. The second report details the conditions necessary to secure suitable artificial lighting, and recommends certain requirements to be included in an Order defining suitable lighting for all factories and workshops. Unsuitable systems of lighting are still common and the condition has been accentuated by the extending use of high-intensity gas-filled electric lamps.

The requirements of suitable lighting are:—Absence of glare and of troublesome shadows; steadiness and constancy of the light source; and a moderate degree of uniformity of illumination and of surface brightness over the plane of work.

To avoid glare, the first essential is proper shading of the light sources. Generally speaking, one type of shade is adapted to one type of lamp only, and to maintain suitable lighting, change of type of lamp often necessitates change of type or readjustment of the shade. The following recommendations for the avoidance of glare are made:—(A) Every light source (except one whose intrinsic brilliance does not exceed five candles per sq. in.) within a distance of 100 ft. from any person employed, shall be so shaded from such person that no part of the filament, mantle, or flame is distinguishable through the shade, unless it be so placed that the angle between the line from the eye to an unshaded part of a source and a horizontal plane is not less than 20°, or for any person employed at a distance of 6 ft. or less from the source, not less than 30°. (B) Adequate means shall be taken, either by suitable placing or screening of the light sources, or by some other effective method, to prevent direct reflection of the light from a smooth or polished surface into the eyes of the worker.

Troublesome shadows are generally due to unsuitable placing of the light sources, and are particularly objectionable when thrown by an object in motion. It is recommended that adequate means be taken to prevent the formation of shadows which interfere with the safety or efficiency of any person employed.

Unsteady and flickering illumination is injurious to vision and increases the risk of accident. It is realised that this detrimental factor, though still existent, is unlikely to arise with a modern system of lighting. It is recommended that no sources of light which flicker or undergo abrupt changes in candle-power in such manner as to interfere with the safety or efficiency of any person employed shall be used in the illumination of a factory or workshop.

It is contemplated that extensive alterations may be necessary in many factories to comply with the suggested requirements, and it is accordingly recommended that, as regards existing installations, a reasonable time limit should be given before the above requirements become operative.

The subject of suitable natural lighting is reserved for a later report, as also are the subjects of mixed lighting, the classification of processes, the lighting of glass-bevelling shops, and the effects of using translucent glass in factory windows.

An Appendix contains extracts from the recommendations of the American and German Illuminating Engineering Societies, and from the codes of lighting now in force in various American States.

COMPANY NEWS.

Van den Berghs, Ltd.—At the meeting held in London on August 12, the Rt. Hon. Lord Ebury, who presided, said that the policy of expansion was being continued. New capital issues had been made at home and on the Continent for the acquisition of interests in France, Scandinavia, Belgium, etc., so that the combined issued capital of all the undertakings now exceeded £6,750,000. The company had been able to cope successfully with the coal strike and other disturbances due to labour, but arrangements had been made to use oil fuel in the event of future trouble. The sum of £1,482,707 brought forward from the previous 1½ years' working had been practically all absorbed by excess profits duty, contingencies, and the bonus paid to ordinary shareholders. The accumulated stocks of raw materials had now nearly disappeared.

Chemical and Metallurgical Corporation.—Speaking at the ordinary general meeting held on August 9, Mr. H. Guedalla, chairman, read extracts from an expert's report on the Elmore process, owned by the Corporation, for separating the metallic contents of complex lead and zinc ores. Tests made on middlings from Burma ore showed that by the process 99 per cent. of the lead was recovered as lead sulphate and 87 per cent. of the silver, leaving a residue containing 50·4 per cent. of zinc, free from lead, which was equivalent to 96 per cent. of the original zinc. The all-in working costs for a plant in England dealing with 500 tons of ore per day, recovering the lead as sulphate, precipitating the silver and separating the zinc residues, should not exceed 10s. per ton. The satisfactory results obtained with the small plant justified the adoption of the process on a large scale, and negotiations were proceeding for the erection of a plant in Australia.

W. J. Bush and Co., Ltd.—The annual general meeting was held in London on August 18, Mr. J. M. Bush presiding. In common with most other industrial concerns, said the chairman, the company had incurred considerable losses through depreciation in the value of stocks, and there had been a big increase in expenses. Owing to the low costs of labour and raw materials in Germany, it was not possible to compete with many German fine chemical manufactures; consequently most of the company's plant had been idle and many trained men had been put out of employment or on short time. The Safeguarding of Industries Bill should help the industry, but all manufacturing chemists realised the temporary nature of the expedient, and that the survival of the industry in the long run depended upon efficiency. In many cases they had found that inability to meet competition was due to the causes above mentioned, and not to lack of efficiency or skill on the part of their chemists. The Government had removed one of the handicaps of the essence industry by allowing certain ethyl compounds to be manufactured from duty-free spirit, so that in this respect English manufacturers were now on terms of equality with their foreign competitors. A dividend of 5 per cent. on the ordinary shares was recommended and approved.

The Welsbach Light Co., Ltd.—In a review of the financial year ended March 31 last, Mr. J. R. Yates, chairman, explained to the annual meeting, held on August 16, that the delay in passing legislation to safeguard "key" industries had had the ill effects foreshadowed a year ago. The dumping of cheap foreign gas-mantles, aided by the general slump in trade, had necessitated the drastic writing-down of stocks and reduced the company's trading profit from about £94,000 to £36,000. The net profit was £13,135 (issued capital £257,925; debentures £87,640), and a dividend of 5 per cent. on the ordinary shares was recommended, leaving £21,582, subject to corporation tax, to be carried forward, as against £21,343 brought in.

TRADE NOTES.

BRITISH.

British Solomon Islands in 1919–20.—Exports and imports in 1919–20 were valued at £212,542 and £181,162 respectively, and would have been higher but for the lack of shipping, strikes in Australia, and influenza. For these reasons the export of copra was only 8160 tons, worth £194,046, as compared with 9891 t. in 1918–19. Other exports were ivory nuts valued at £3270 and trocas shell worth £13,638. Some slight improvement took place in the labour supply, but the gradual depopulation of the islands continues.—(*Col. Rep.-Ann., No.* 1060, *Feb.,* 1921.)

The Bahamas in 1919–20.—The trade of this colony increased considerably in 1919–20, the import trade being especially good owing to heavy purchases of materials that were unobtainable during the war. Of the exports, valued at £382,140, 87 per cent. consisted of raw materials, and 63·67 per cent. went to the United States and 16·54 per cent. to the United Kingdom. Exports of sisal increased by 224 tons to 2831, and were valued at £204,437. The value of the imports was £539,242, to which the United States contributed 81 and the United Kingdom 6 per cent. High freight rates and lack of transport affected trade with the United Kingdom. Inagua, one of the Out Islands, contains extensive salt-pans which were formerly a source of considerable revenue to the Crown. In 1919 the output was 168,000 bushels, and a company has recently been formed to reopen the salt trade. Salt-making is also carried on at Ragged Island (*cf.* J., 1920, 366 R).—(*Col. Rep.-Ann., No.* 1059, *Feb.,* 1921.)

FOREIGN.

Italy's Foreign Trade in Chemicals.—The Italian foreign chemical trade during the past four years is summarised as follows (in million lire):—

Imports.	1917	1918	1919	1920
Chemical products and medicines	1350	1486	673	659
Dyes and tanning materials	213	474	105	198
Exports.				
Chemical products and medicines	238	145	250	412
Dyes and tanning materials	15	16	27	42

The imports in 1920 included:—Tanstuffs 48·2 mill. lire; caustic soda 35·2 mill. lire; Chile saltpetre 64 mill. lire (49,205 metric t.); chemicals 52·3 and coal-tar dyes 107·2 million lire. Among the exports were:—Citric acid 31 mill. lire (1829 t.); tartaric acid 35 (2918 t.); and glycerin 13 mill. lire (2972 t.). The exchange value of the lira fluctuated between 2½d. and 5d. during 1920.—(*Chem. Ind., June* 20, 1921.)

Trade in Lithuania in 1920.—The total imports into Lithuania in 1920 were valued at 428,728,541 ost marks and exports at 521,797,163 ost marks (ost mark = 11·75 d. at par, now 0·92d.). Foodstuffs and textiles constituted over one-half of the imports; two-fifths of the exports consisted of flax, and one-fourth of timber. The values of the chief imports and exports are given below in thousands of ost marks:—

Imports :—	
Chemicals	17,760
Medicines and drugs	1,635
Sugar	65,996
Salt	16,759
Metals, manufactured	36,198
Minerals and manufactures of	18,162
Oils	6,535
Kerosene	12,559
Exports :—	
Flax (approximate value)	200,000
Linseed	59,521
Leather and hides	2,674
Mineral products	1,312
Iron	2,052
Wood and timber	126,564

—(*U.S. Com. Rep., May* 11, 1921.)

Marketing of Carnauba Wax in San Paulo, Brazil.—The carnaüba wax produced in the states of Piauhy, Ceara, Rio Grande do Norte and Bahia is not, as a rule, submitted to chemical examination as this is difficult and causes delay, but is classed under the following grades:—(1) "Arenosa" (sandy), low grade wax of light to dark grey colour, with a harsh feel and the appearance of being mixed with sand though not containing sand when of good quality. (2) "Gordurosa" (fatty) is somewhat superior to the last-mentioned, varies in colour from deep yellow to almost black, and owes its name to its appearance of being covered with powdered resin. (3) "Mediana" (medium) wax of a somewhat yellowish light grey and of better quality than the preceding grades. (4) "Primeria" (first), wax of a yellow colour, more uniform appearance than "Mediana" and containing less impurity. (5) "Flor" (flower) wax of a bright egg-yellow colour and, unlike all the other grades, almost entirely free from impurity.

A rough test for heavy impurities such as sand and earth, consists in placing fragments of the wax in cold water; the pure wax which floats may be separated from the impure wax which sinks and the two fractions weighed. The wax is generally sold by the "arroba" (15 kg.), packed in jute sacks containing 80—100 kg., an allowance (usually 0·5—1 kg.) being made for earth.—(*Rev. Prod. Chim., June* 30, 1921.)

Trade of Paraguay in 1920.—Paraguay is purely an agricultural and pastoral country and almost all the manufactured goods required are imported. Industries are limited to the small-scale production by primitive methods of soap, candles, matches, sugar, pottery, quebracho extract, etc. Imports in 1920 were valued at 13,118,504 gold pesos (gold peso = 3s. 11½d. at par) and exports at 14,959,175 pesos. The imports, together with the percentages supplied by the chief countries, included:—Chemicals, drugs, mineral oils, and paints, 1,014,672 pesos (Arg. 33·6, U.S. 47·4, U.K. 5·0); china, glassware, earthenware, 112,611 pesos (Arg. 57·5, U.S. 10·2, U.K. 6·9); paper, perfumery, etc., 1,028,248 pesos (Arg. 35·0, U.K. 18·0, Fr. 17·1). About 85 per cent. of the imports came from Argentina, United States, and the United Kingdom, the last two countries supplying 24 and 20 per cent., respectively. The principal exports were, in metric tons:—Quebracho extract, 24,061; quebracho logs, 0·2; tallow, 23; petitgrain, essence of, 74; and 198,965 hides. Of the exports 56 per cent. went to Argentina, 12 to

France, 9 to the United States, and only 3 per cent. to the United Kingdom.—(*U.S. Com. Rep., June* 21, 1921.)

Aniseed Oil in the Far East.—*Finance and Commerce* (Shanghai) has recently published an article on the aniseed-oil industry in the Far East, in which it is stated that in China the oil is not extracted from the seed by pressing but by distillation, mainly at Hongkong but also in southern China, in Nanning and in Canton. The yield of oil is about 3 catties from 20—30 catties of dried seed, corresponding to one picul of fresh aniseed (catty= 1·33 lb., picul=133·33 lb.). Aniseed oil from Hongkong is always packed in small lead cannisters, each containing 15 lb. of oil, and four cannisters are packed in each wooden case. Owing to its high price, aniseed is always liable to be adulterated, but there is little risk of this at present as samples of the sealed packages have to be drawn and analysed by the Hongkong Government Analyst prior to shipment. Great Britain, the United States, and France are the chief importing countries, but Italy is said to be an intending large purchaser. In addition to its use in medicine, aniseed oil is used in the preparation of liqueurs.—(*Ch. of Comm. J., July* 8, 1921.)

REVIEWS.

A French-English Dictionary for Chemists. *By* Austin M. Patterson. *Pp. xvii.*+384. (*New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.* 1921.) *Price* 18s. *net.*

Every technical man who wishes to acquaint himself with the progress made outside of his own country in his particular subject, a need which is to-day practically universal, is generally faced with the difficulty of correctly interpreting the foreign technical terms that he meets with. For this purpose an ordinary dictionary is very nearly useless and may indeed prove misleading. An example in point is the case of the well-known English astronomer, who, wishing to render one of his papers into French, painstakingly translated "the Eastern hemisphere" as "*le demi-monde oriental*"; he no doubt looked up the words and found them quite correctly in his dictionary, but he certainly failed to convey his meaning to a French audience. For ordinary purposes it is essential to remember that transliteration is not translation, and that the essence of good translation in the ordinary literary sense is to translate meanings and not words. In technical translation the case is different because technical words admit of being precisely translated into practically any modern language, but only on condition that the strict equivalents are known, and that the translator knows when he is dealing with a word used in a technical sense and when with a word used colloquially. For such purposes the use of a technical dictionary is almost indispensable, and fortunately there are a number of such works in existence. The real difficulty that faces the compiler of such a dictionary lies in the determination of what to omit and what to include. On the one hand, he ought to exclude all colloquial words that have not a special technical signification and which may be found in a general dictionary of the language; on the other hand, he ought to include terms used in allied branches of technology. For example, the chemist requires to understand not purely chemical words only, but also the terms used by electricians, engineers, masons, carpenters, etc.; in fact, it is difficult to say what technical terms he may not on occasion require to interpret. There is, however, the advantage, as already pointed out, which the compiler of the technical dictionary possesses over the author of a general dictionary —namely, that he is dealing with words that admit of exact and complete translation inasmuch as they do possess precise equivalents.

The little work before us is intended primarily for chemists, and appears to have fulfilled its purpose very well indeed as far as the main object is concerned. It departs from the principles above enunciated, inasmuch as it gives a large number of colloquial French words which are to be found quite readily and correctly in any French dictionary. The man who needs to have these words translated for him could probably not dispense with the use of the latter dictionary and the object of inserting them is by no means obvious. Again, Mr. Patterson's work is decidedly weak on the engineering side. It is difficult to understand what class of reader is likely to benefit by the seven or eight pages devoted to the conjugation of French verbs; there is far too little here for the man ignorant of French grammar, whilst the information is superfluous for the man who has had an elementary grammatical training. Apart from these points, which after all are matters of opinion, the work that the author has set himself to do is well done; there are but few omissions, and perhaps still fewer actual mistakes, and the little work ought to be decidedly useful and acceptable to a wide circle of readers who may have a fair general knowledge of the French language, but are not familiar with the phraseology employed by French chemists.

Henry Louis.

Electrochemisches Praktikum. *By* Dr. Erich Müller. *Third revised and enlarged edition. Pp. xvi.*+254. (*Dresden and Leipzig: Th. Steinkopff.* 1920.) *Price, paper,* 20 *marks.*

Die Elektrometrische Massanalyse. *By* Dr. Erich Müller. *Pp. vi.*+110. (*Dresden and Leipzig: Th. Steinkopff.* 1921.) *Price, paper,* 8s. 3d. *net.*

Prof. Müller's "Elektrochemisches Praktikum" has gone through three editions since 1912, and is one of the best small text-books on practical electrochemistry. The underlying theory is in all cases clearly and concisely presented, the instructions for preparing the apparatus and carrying out the experiments are adequate, and the methods of calculation of the results are, in more difficult cases, explained by examples. The experimental work covers a wide field and includes practically all the technical processes in use. The fundamental laws of electrochemistry are illustrated by experiments, including measurements of conductivity, transport numbers, electromotive force, electrode potentials, concentration cells, oxidation and reduction, decomposition voltage, electrolytic and electrometric analysis, deposition of metals, and an excellent series of electrochemical preparations, including electrothermal processes. Although intended as a laboratory guide for students, the book should be interesting to all chemists concerned with electrochemical processes, whether actual or potential.

Electrolytic quantitative analysis is now fairly well known and is considered in most books on quantitative analysis which profess to be abreast of the times. Electrometric quantitative analysis, although familiar to "academic" chemists, is comparatively new in its technical applications, and Prof. Müller's monograph gives a concise and clear account of the progress made up to date in this field. The principle of the method is the application as an indicator of the E.M.F. of a cell composed of a normal electrode and an electrode in a solution of an ion which is to be estimated. When the solution is titrated with a reagent which diminishes the ion concentration, the E.M.F. undergoes a sharp change at the "end-point." The theory of the method is not so simple as that of electrolytic analysis, and some knowledge of the principles of physical chemistry is required in the application of the method. An outline of the theory is given, and although the degree of accuracy at present attained is not very high, the method may often be useful and should be known to chemists.

J. R. PARTINGTON.

INTERNATIONAL HANDBOOK. THE WORLD'S CHEMICAL INDUSTRY AND TRADE, 1913–14 TO 1919–20. *By* DR. W. A. DYES. VOL. I. *Pp. xx.+752. (Wittenberg: Hopf'sche Verlagsbuchdruckerei Gebr. Jenne, G.m.b.H.* 1921.) *Subscription Price to Volumes I. and II.:* 650 *paper marks.*

This work of reference is intended primarily to benefit those engaged in the chemical industries, who by reason of and during the war were isolated from the records of progress in other countries. To this end the author has collected, obviously at enormous pains, extracts of an informing or polemical character from the scientific, technical, trade, daily and weekly press of the period in question and arranged these under some two hundred and fifty subject-headings. The matter is in different languages, chiefly English and German; some of the extracts from English and American sources are given in German translations, others are left in English, but the comparatively few extracts from German sources are all in the original language. From this and other internal evidence, it is apparent that the work renders its greatest service to the German reader who was cut off from the literature of countries at war with his own. Extracts from German reviews, which are enclosed with the book, indicate that the service thus rendered is fully appreciated.

As typical of the matter we may take that under the heading "Dyestuffs." The section opens with statistics regarding the value and quantities of the dyestuffs exported by Germany before the war and the consumption of dyes in England and the U.S.A. A table (from an American source) gives particulars of the capital of the companies included in the German Interessengemeinschaft, but there is no further information regarding the progress or condition of the colour industry in Germany. The remainder of the section describes the attempts which have been made in England, America, and Japan to wrest a share of this industry from Germany, and quotes articles and speeches bearing upon the advisability of such efforts and their probable failure or success.

The section on "Gas Warfare" consists of quotations from English, French, and American writers all pointing out that whoever may have introduced this form of warfare, it has certainly "come to stay."

The present volume is described as "Volume I"; it would therefore be unreasonable to point out omissions, but the hope may be expressed that progress made in many directions—such, for instance, as the electrolytic production of hydrogen peroxide, which is not mentioned in this—will be recorded in subsequent volumes. The book contains also a list of chemical manufacturers, which is so incomplete that its object is hardly ascertainable—the English section bristles with misprints and misspellings.

Whilst congratulating the author whole-heartedly on the onerous task he has performed and on the interesting and valuable nature of much of the material which he has collected, one can hardly ascribe to his work that "international" value to which his title and preface lay claim. Though we sympathise fully with his ideal that scientific and technical knowledge should know no national frontiers, we feel that the relatively small proportion of information from German sources contained in the volume, to whatever cause this is due, renders it impossible to accept it without reservation as an impartial work of reference.

REGINALD BROWN.

THE CLAYWORKER'S HANDBOOK. *By* A. B. SEARLE. *Third edition, revised, enlarged, and largely rewritten. Pp. viii + 381. (London: Charles Griffin and Co., Ltd.* 1921.) *Price 21s. net.*

The fact that this book has reached a third edition may be taken as an indication that it has supplied a want. Since (according to the preface) it has been practically rewritten, it becomes in a sense a new book, but as it has been presumably put together much on the same lines as the preceding editions, the chief concern of a reviewer should perhaps be to examine its reliability and to see if it has been brought up to date. It may at once be stated that the book should be useful to those for whom it is chiefly intended, namely, clayworkers. The chapters deal with materials, preparation of the clay, machinery, transport, drying, glazing, kilns, firing, defects, waste, tests, etc. An appendix of about 40 pages contains information relating to British and metric weights and measures, specifications (for firebricks, silica bricks, etc.), tables, etc., together with a lengthy list of books and journals dealing with clay working. There are helpful illustrations, and there is also a comprehensive index which adds much to the value of the work.

Numerous cross references appear throughout the book, not only to other parts of the volume, but to other publications of the author. The book would have been more useful if fuller references had been given to the sources of information respecting the more important investigations of other authors. This may possibly have been intentional, having regard to the kind of people for whom the book was avowedly written, but one cannot help thinking that additional particulars to complete the references would have been well worth inserting. Another matter which deserved more attention than it apparently received is that of proof-reading. Misprints are decidedly more numerous than is desirable in a work of this character, and although it fortunately happens that most of them are trivial —such as the reference to "the earlier stages of firing continuous *films*" on p. 169—others occur which might mystify (temporarily, at any rate) the class of reader for whom the book is mainly intended. An example is to be found on p. 123 ("If the *heat* is not allowed to leave the dryer until it is saturated," etc.). Occasionally positive mis-statements are encountered, as the reference on p. 180 to "a *black* calcium sulphide," and on p. 231 the assertion that "the potassium [in 'orthoclase'] may be partially, or entirely, replaced by one of several other metals such as sodium, *calcium*, etc., and in each case the new mineral retains its family name of felspar."

There is no great harm done—to the reader, at all events—if an author persists in using such expressions as "between each article" (p. 211), because, whatever view may be held as to the grammatical construction, the meaning can scarcely be in doubt. But such a statement as that "1 gramme of water measures 1 c.c." (p. 314) should surely not be made without qualification, and the tables on pp. 322—324 are marred by quite a number of inaccuracies, such as $FeSO_4 9H_2O$ (copperas), PbS_2 (galena), $CaSO_4 2H_2O$ (stucco or plaster), SbO (antimony oxide), etc. It might reasonably have been expected that an experienced writer like the author of the book under review would not have exposed himself to such strictures. His book contains a large accumulation of valuable information, and it should not have been difficult to avoid setting puzzles to those for whom he writes more particularly and who are not likely in most cases to be sufficiently well equipped as regards general training to solve them. It may be added that recent publications have been largely drawn upon in order to bring the subject-matter up to date.

James A. Audley.

Indiarubber Goods Manufacture. *By* "Factory Manager." *Pp.* 496. (*London: Maclaren and Sons, Ltd.* 1920.) *Price* 30*s. net.*

Those not intimately acquainted with the rubber industry can scarcely be expected to appreciate the highly specialised nature of each of the many branches into which it is divided, which accounts for both its non-standardised character; and the lack hitherto of any reliable book dealing with the technical aspect of manufacture. Perusal of the present work will at least make it apparent that in attempting to describe all the problems of design, organisation, costing, administration, and manufacture calling for consideration in a factory making, among other articles, tyres, hose, tiling, mechanical goods, rollers, spread goods, etc., the author has undertaken an ambitious task beyond the scope of any save one with a long and intimate experience in each of the several branches surveyed. This versatility the reviewer does not profess to claim, and his judgment in assessing the measure of success to which the author has attained must of necessity be based largely on those portions of the work relating to branches of the industry with which he has had practical manufacturing experience.

Examination of the information given regarding the washing and drying of the raw rubber, however, does not engender confidence in the reliability of the author's experience. A would-be manufacturer basing his estimates for the output of his air-drying rooms on the use of a temperature of 60°—70° C. and a drying period of two days would almost certainly require to revise his estimates and modify his practice radically. The chapter on raw rubbers deals with many wild types which are now of historical interest only, and that on the mineral ingredients employed in rubber-mixings obviously stamps the writer as not being a chemist, a conclusion supported by numerous other passages scattered throughout the book. The brief treatment accorded to the equipment of the spreading shop is far from up-to-date and includes no reference to the modern enclosed dough-mixers or to the automatic measuring-pumps now generally employed for delivering solvent for the preparation of rubber solutions. In describing the processes of vulcanisation with sulphur chloride, after-treatment with ammonia is referred to casually as an occasional antidote to remove any objectionable odour, whereas such treatment is indispensable if tendering of the textile as a result of the formation of hydrochloric acid is to be avoided.

Although sufficient has been said to show that this book falls far short of a general *vade mecum* for those engaged in the industry, the writer obviously possesses considerable inside experience of rubber manufacture, and to those with sufficient technical knowledge to discriminate, the information in certain sections should prove of considerable assistance. It, moreover, represents a genuine attempt to treat the subject from the manufacturer's standpoint, and is not, as is so often the case with books of a technical character, a mere compilation from engineering catalogues and patent specifications. For these reasons the author is to be congratulated on his effort, which, it is hoped, may serve as a basis for some future work in which the subject-matter is revised, rearranged, and by the co-operation of an engineer and a chemist treated adequately from every aspect.

B. D. Porritt.

PUBLICATIONS RECEIVED.

Organic Compounds of Mercury. *By* Prof. F. C. Whitmore. *American Chemical Society Monograph Series. Pp* 397. (*New York: The Chemical Catalog Co., Inc.* 1921.) *Price* $4.50.

Final Report of the Departmental Committee on Spontaneous Combustion of Coal in Mines. *Mines Department. Pp.* 115. (*London: H.M. Stationery Office.* 1921.) [*Cmd.* 1417.] *Price* 1*s.* 6*d.*

National Physical Laboratory. Report for the Year 1920. *Pp.* 132. (*London: H.M. Stationery Office.* 1921.) *Price* 5*s.*

Reports on Jute and Silk. *Indian Trade Inquiry. Imperial Institute. Pp.* 90. (*London: John Murray.* 1921). *Price* 5*s.*

Bulletin of the Imperial Institute. *Vol. XIX. No.* 1. (*London: John Murray.* 1921.) *Price* 3*s.* 6*d.*

Annual Report of the Department of Agriculture for the Colony of Mauritius, 1920. *Pp.* 19. *Port Louis.* 1921.

Publications of the Netherlands Government Rubber Institute, Delft, 1921:—

The Principal Methods of Chemical Analysis used at the Netherlands Government Rubber Institute. *Pp.* 15.

The Netherlands Government Rubber Institute and its Sphere of Activity. *By* Dr. A. van Rossem. *Pp.* 14.

Mineral Resources of the United States. 1917. Part I.—Metals. *United States Geological Survey. Department of the Interior. Pp.* 980. (*Washington: Government Printing Office.* 1921.)

Thermal Expansion of Copper and some of its Important Industrial Alloys. *By* Peter Hidnert. *Scientific Papers of the Bureau of Standards. No.* 410. *Pp.* 91—159. (*Washington: Government Printing Office.* 1921.) *Price* 25 *cents.*

The Lilly Scientific Bulletin. *Series* 2, *No.* 1. *Pp.* 26. (*Indianapolis: Lilly and Co.* 1921.)

Year Book of the Michigan College of Mines. 1920–21. *Pp.* 125. (*Michigan College of Mines, Houghton, Michigan, U.S.A.* 1921.)

Publications of the United States Geological Survey. *Department of the Interior.* (*Washington: Government Printing Office.* 1921):—

Graphite in 1919. *By* L. M. Beach.

Fluorspar and Cryolite in 1919. *By* H. W. Davis.

Asphalt and Related Bitumens in 1919. *By* K. W. Cottrell.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

THE PRESIDENT'S ADDRESS.

In the Usher Hall, Edinburgh, on September 7, the Presidential Address of Sir T. Edward Thorpe, on "Some Aspects and Problems of Post-War Science, Pure and Applied," was read in his absence, owing to indisposition, by Sir J. A. Ewing, vice-chancellor of the University of Edinburgh. Among the more important topics considered were the relation of the State to scientific research, recent advances in the theory of the structure of the atom, and the ethics of chemical warfare.

The British Association owes its origin, and, in great measure, its specific aims and functions, to the public spirit and zeal of Scotsmen. Sir David Brewster, president in 1850, was its virtual founder, and Principal Forbes its chief architect. In 1834 the then president, the Rev. Prof. Sedgwick, indicated the great power which the Association is able to exercise in promoting the advancement of science by combination and united action, and contended that one of its most important functions is to further the "commerce of ideas" by holding joint discussions on subjects of kindred interest. This phase of the Association's activities is to be emphasised at the present meeting by the holding of many more joint meetings of allied sections to discuss problems of general interest; and another noteworthy change in procedure will be the introduction of discussions on the addresses of Presidents of Sections.

Brewster, who had a lofty ideal of the place of science in the intellectual life of a community, and of the just position of the man of science in the social scale, pleaded for the establishment of a national institution, possessing a class of resident members who should devote themselves entirely to science, and who should be "free alike from the embarrassments of poverty or the temptations of wealth"; such men should do more and better work than those who snatch an hour or two from their daily toil or nightly rest. This ideal was not attained in Brewster's time, nor has it been reached in our own. At the meeting of the Association in Edinburgh in 1871, Lord Kelvin pursued the same thought, urging the view that "experimental research should be made an object of national concern, and not be left, as hitherto, exclusively to the private enterprise of self-sacrificing amateurs, and the necessarily inconsecutive action of our present Governmental Departments and of casual committees." Lord Kelvin pleaded more particularly for the institution of physical observatories and laboratories, and it was not long before the Cavendish Laboratory at Cambridge and, thanks to the initiative of the late Lord Salisbury, the National Physical Laboratory were established. The achievements of these institutions bear remarkable testimony to the value of organised and continuous effort on the part of the British Association.

The fifty years which have elapsed since Lord Kelvin was president have been extraordinarily fruitful in physical and chemical discoveries. Probably no previous half-century has witnessed such momentous achievements. In pure chemistry, the discoveries of argon, radium, helium as a terrestial element, neon, xenon and krypton, the production of helium from radium, the isolation of fluorine, may be quoted as of outstanding importance, whose value is enormously enhanced by the theoretical and practical consequences which flow from them. In applied chemistry, the Gilchrist-Thomas process of iron-purification, the production of calcium cyanamide by the method of Frank and Caro, Sabatier's process of hydrogenation, a widespread application of liquefied gases, and Haber's work on ammonia synthesis, have revolutionised the industries with which they are concerned. In pure physics the past half-century has witnessed the rise of the electron theory, the discovery of electromagnetic waves, the investigation of cathode rays, and the elucidation of crystal structure. It has seen, moreover, the invention of the telephone, the establishment of incandescent lighting, the electric transmission of force, the invention of the kinematograph, of wireless telegraphy, the application of the Röntgen rays, and the photographic reproduction of colour. In physical chemistry it has witnessed the creation of stereochemistry, the formulation of the phase rule, the theories of solution, of ionic dissociation, and of the galvanic cell. Such a list is far from complete, but it is pregnant with meaning.

Another matter which Lord Kelvin urged the Association to take up was the more rapid dissemination of information concerning the results of scientific investigation; this, happily, has been accomplished. The timely aid given by the Association to the Chemical Society to enable it to prepare and publish monthly abstracts is gratefully remembered by British chemists, and the example has been widely followed by other scientific and technical societies. At the present time there is almost an embarrassment of riches in the sphere of chemical abstracts, and there is much need for co-operation among the various distributing societies, particularly in view of the greatly increased costs of publication.

All thinking men are agreed that science is at the basis of national progress. The industrial position of a nation, its wealth, welfare and stability depend upon invention, which in its turn depends upon research. The reiteration of this obvious fact was never more needed than now, for it is, unfortunately, only too true that in the past the industrial world has underrated the value of research. The establishment of the Department of Scientific and Industrial Research marks an epoch in our history, and is bound to exercise a profound influence upon industries where success depends upon discovery and invention. It has been so organised as to obviate many of the objections which have been urged against the endowment of research, and to be in harmony with the modern democratic view—and against that expressed by Brewster—that no institution should be created to which definite work is not assigned and from which definite results do not emanate. The Department has wisely left considerable freedom to the individual worker; it has created many new research associations, and has aided and co-ordinated the activities of both old and new.

Recent advances in the elaboration of the atomic theory of the structure of matter show that science advances less by fundamental alterations in its beliefs than by additions to them. The investigation of the inner mechanism of the atom has profoundly modified the basic conceptions of chemistry. The discovery of the electron, the production of helium in the disintegration of radioactive atoms, the recognition of the existence of isotopes, the possibility that all elementary atoms are composed either of helium atoms or of atoms of hydrogen and helium, and that these atoms in their turn are built up of the electron and a particle of positive electricity whose mass is practically identical with that of the same atom, are pregnant facts which have completely altered the fundamental aspects of the science. It is interesting to note that Graham, in his "Speculative Ideas respecting the Constitution of Matter" (1863) threw out certain suggestions which have a distinct bearing upon recent results. In this paper Graham conceived of a lower order of atoms than the chemical atom of Dalton, and founded on this conception an explanation of chemical combination based upon a fixed combining measure, which he termed the "metron," its relative weight being one for hydrogen, sixteen for oxygen, and so on with the other so-called "elements."

The results of the work of Aston and J. J. Thomson on isotopes, including the existence of H_3, first detected by the latter, and Rutherford's work on the disruption of oxygen and nitrogen are of extraordinary interest as bearing on the question of the essential unity of matter and the mode of genesis of the elements, a subject which was considered many years ago by Crookes, Marignac, Schutzenberger, and Lockyer, who in many instances foresaw the results of recent workers. The comprehensiveness and sufficiency of the prevailing theory of the constitution of the atom are well illustrated by the explanation it affords of the Periodic Law, atomic numbers, and valency. In the light of recent researches, the term "atomic weight" has acquired a new and much wider significance. The existence of isotopes appears to have introduced greater complexity, but it may be found that greater simplicity will result. If the number and relative arrangement of the atomic protons and electrons be known, it may be possible to arrive at the atomic weight by simple calculation, on the assumption that the integer rule is mathematically valid; but, apparently, this is not so, owing to the influence of "packing." But the little differences may make all the difference, and it is in their determination that important new facts may be brought to light. In view of recent developments, it has become necessary to reorganise the work of the small International Committee on Atomic Weights which was appointed in 1903, and this has already been taken in hand by the International Union of Pure and Applied Chemistry (*cf.* J., 1921, 267 R).

The late war, which has so profoundly affected almost all human activities and relations, differed from previous wars in the extent to which organised science was invoked and systematically applied in its prosecution; but nothing shocked the conscience of the civilised world more than Germany's cynical disregard of her undertaking not to use lethal gas in warfare. Advocates of chemical warfare contend that poison gas is far less fatal and much less cruel than any other instrument of war, and that, as a method of conducting war it is more humane than preventive medicine, which by safeguarding the health of combatants renders possible the maintenance in the field of enormously greater armies, and thus provides greater scope for the destructive activities of other military weapons. This argument carries no conviction. The use of poison gas is not merely contrary to European military traditions; it is repugnant to the right feeling of civilised humanity. It in no wise displaces existing instruments of war, but creates a new kind of weapon of limitless power and deadliness. "Mustard gas" may be comparatively innocuous, but it was not intended to be so by the combatants; nor is it at all likely that the use of lethal gas will be confined to that of "mustard gas." To one who, after the peace, inquired in Germany concerning German methods of making "mustard gas," the reply was, "Why are you worrying about this when you know perfectly well that this is not the gas we shall use in the next war?" It is the legitimate business of preventive medicine to preserve the health of any body of men, however large or small, committed to its care, and it is not to its discredit if the numbers so maintained run into millions instead of being limited to thousands. The British Association could have no loftier task than to use its great influence in arresting a course which is the very negation of civilisation.

THE LABORATORY OF THE LIVING ORGANISM.

The continued recognition of the importance of that side of chemistry which deals with the elucidation of the processes of life is shown by its forming the subject of the presidential address to the Chemistry Section of the British Association, delivered by Dr. M. O. Forster, F.R.S., at the annual meeting in Edinburgh on September 8. In addition to a general survey of the present knowledge concerning some of the groups of chemical substances which are operative in the living organism, notable emphasis was laid on the æsthetic value of an acquaintance with the principles of chemistry, sufficient to enable the educated citizen to realise the intimate part played by the science in his daily life.

Whilst deprecating the selection of chemistry as an occupation without definite vocation (a pertinent warning at a moment when the profession is being entered upon by many more than can reasonably expect to find in it the inspiration which alone may bring an adequate reward), Dr. Forster insisted that appreciation of the general outlines of the subject would add to the mental equipment of our people a source of abundant intellectual pleasure, since every living plant, animal, and human being is a practical organic and physical chemist, conducting analytical and synthetical processes of the most complex order with imperturbable serenity.

The minute cells of which our bodies are coordinated assemblages, by the production and application of enzymes, possess a power of synthetic achievement contrasted with which the classical syntheses of organic chemistry are but hesitating preliminaries, whilst the carbohydrates, alkaloids or glucosides, complex as they seem from the standpoint of molecular structure, are but *débris* strewing the path of enzyme action and photochemical synthesis. Furthermore, whilst plants effect synthetic processes from carbonic acid, water and nitrogen, the animal system is powerless to utilise these simple starting materials until they have been assembled into more complex forms by plants.

Recent advances in the chief divisions of biochemistry were considered, and the work of R. Robinson in effecting syntheses of alkaloid derivatives from simple substances such as succinic dialdehyde, acetone and methylamine was mentioned. The structure of nucleic acids was discussed in some detail, with especial reference to the researches of W. Jones and P. A. Levene on the degradation of these acids by the appropriate phospho-nuclease and purine-nucleases through adenine, guanine or other purines to the ultimate product of purine metabolism—uric acid in man and apes, allantoin in other animals.

Willstätter's researches on chlorophyll and hæmoglobin show that these pigments are fundamentally related, since both can be converted into a substance, aetioporphyrin, composed of a system of condensed substituted pyrrole nuclei. The mechanism by which they act is not yet known, but Baeyer's "assimilation hypothesis," enunciated in 1870, and according to which formaldehyde is the connecting link between carbonic acid and sugars, still holds the field in spite of numerous criticisms. This view has received fresh support from the work of Willstätter and Stoll upon the assimilatory quotient (the relation of the carbon dioxide absorbed to oxygen liberated) obtained from many types of foliage under varying conditions of temperature and atmospheric composition.

The additions to our knowledge of the colouring matters of flowers and fruits (the anthocyans) made in the past decade by Willstätter and his school were summarised. The anthocyans are glucosides in which the non-carbohydrate part (anthocyanidin) is essentially an oxonium compound related to a flavone or flavonol. There are three fundamental anthocyanidins, pelargonidin, cyanidin and delphinidin, related respectively to kaempferol, quercetin and myricetin; the varied pigments affording the blues and reds of practically all coloured flowers and fruits consist either of these three anthocyanidins or of their substituted methyl derivatives coupled with aldose molecules in varying kind and number, so that a large group of closely related anthocyans results. The production of the anthocyans is probably connected with the reduction by the plant metabolism of corresponding yellow flavonol derivatives in the sap of the respective plants. The suggestive attempt of Keeble and Armstrong to correlate the inheritance of colour factors in plants with the presence of specific enzymes and chemical substances might have been added in illustration of the investigations in this field.

Recent work on the mechanism of fermentation was dealt with, and attention was directed to the necessity for inquiry into the diverse activities of micro-organisms. The outstanding technical achievements of glycerol production from sugar and of acetone and butyl alcohol manufacture from starch was noted, together with the substitution of *Mucor Boulard* and *Bacillus mesentericus* for malt in effecting saccharification of starch. On the theoretical side some advances had been made of late years in explaining parts of the merchanism of fermentation by yeast. The role of the co-enzyme in yeast zymase and of increased fermentation due to the addition of phosphates was connected by Harden and Young with the function of an enzyme hexosephosphatase, and the later stages of alcoholic fermentation were now believed to follow the intermediate production of pyruvic acid, which under the influence of carboxylase broke down into carbon dioxide and acetaldehyde, the latter being reduced to alcohol by hydrogen from the remainder of the original hexose molecule. The specific functions of various bacteria and moulds were illustrated by the recent work of E. C. Grey on the acid fermentation induced by *Bacillus coli communis*, of J. N. Currie on the citric and oxalic acid fermentation of *Aspergillus niger*, and of Wehmer on the citric- and fumaric-acid fermentation of *A. fumaricus*.

After discussing Moore's proposed revision of existing views of the exact function of chlorophyll in the photosynthetic processes by which carbon dioxide and water are elaborated into carbohydrate material in the plant, Dr. Forster concluded a stimulating adress by further insistence on the urgency of general education of our people in the elements of chemical and biological science, not only on the grounds that this would so greatly enhance the æsthetic value of life, but also because chemistry and its applications are becoming increasingly indispensable to the welfare of humanity. The existing system of elementary chemical teaching was adversely criticised for its devotion to the periodic system and instruction in the habits of the rarest elements, whilst neglecting the vitally important compounds derived from carbon, hydrogen, oxygen, and nitrogen. There is no reason why organic chemistry, which deals with the compounds that count most in the life of us all, should not be taught, not necessarily to the exclusion of the other non-metallic and metallic elements and compounds, but certainly simultaneously with the inorganic division, so soon as the fundamental principles of the science itself have been grasped.

AMERICAN STANDARDS FOR QUALITY OF WATER.

J. J. HINMAN, Jr.

In a recent number of the *Journal* of this Society (¹), the reviewer of an American book on water supply and water purification made a statement concerning water-supply standards in America which may easily create an incorrect impression of the state of the science and art of water purification in the United States and Canada. It seems necessary, therefore, to present the following brief account of American standards of water supply in order to correct such an impression.

The statement in the review to which reference is made is as follows:—"A word may here be said on the difference between English and American standards. The Americans seem to be content with a standard based on percentage reduction, whilst in this country an absolute standard is generally insisted upon. Thus, if the raw water contained, say, *B. coli* in 0·001 c.c., and in the finally purified effluent this was reduced to a positive result with 1 c.c., they would call this a 99·9 per cent. reduction and be satisfied with it, but in this country we are not completely satisfied with sending water into consumption even with *B. coli* in 100 c.c."

The percentage removal of bacteria as a method of gauging the efficiency of filter-plant operation has been in bad repute in America for a number of years, since it is obvious that any given percentage efficiency allows a rapidly increasing bacterial content in a filtered water as the number of bacteria in the raw water becomes larger. This calculation of percentage removal was in most cases applied to the total bacterial content of the water rather than to the number of organisms of the *Bacterium coli* group present.

It is realised that some suitable method of determining the efficiencies of filter plants and of expressing the results in a simple numerical way would be highly desirable. Studies have been made, and are being undertaken, to determine permissible filter-loadings, and to decide what should be demanded of filter plants when handling waters of varying type. No general agreement has been reached. Pending such agreement some filter companies retain the clause respecting percentage removal of bacteria as a part of their guarantees. They commonly specify that when the bacteria in the raw water exceed 3000 per c.c., there shall be a bacterial removal of 97 per cent., and when there are less than 3000 bacteria per c.c. in the raw water, there shall not remain more than 100 bacteria per c.c. in the filtrate. Further treatment by a germicidal substance, such as calcium hypochlorite, or liquid chlorine, is understood. Moreover, this percentage reduction applies to the total bacterial count, and not to the numbers of organisms of the *B. coli* group.

But the significance of the organisms of the *B. coli* group is not agreed upon when the data concerning them and their relative abundance are applied to waters of different sources. Judging from his experience with English water supplies while detailed as Water Supply Officer in charge of the water supplied to troops of the American Expeditionary Forces stationed in and passing through Great Britain, the writer doubts if any such general agreement has been reached in England. He feels sure that the occurrence of organisms of the *B. coli* group in a chalk well in Hampshire would occasion more concern than if they were found, for example, in like numbers in water obtained from an upland source in Montgomeryshire, where the catchment areas had been carefully freed from the possibility of human contamination, but where sheep were pastured.

A considerable number of standards, some based upon extensive investigation and some purely arbitrary, have been proposed for the waters of specific parts of America, or for those of the United States as a whole. Of these there are two which, by their governmental prestige, are best known and most generally considered. These are the tentative standard of the International Joint Commission on the Pollution of Boundary Waters defining a reasonable maximum burden in the form of sewage pollution of the raw water of filter plants (^{2}), and the Standard of the United States Treasury Department limiting the permissible bacterial content of the waters supplied by common carriers to passengers in inter-state traffic (^{3}). The latter standard is also sometimes called the standard of the United States Public Health Service. This Service is under the Treasury Department. Both of these standards were adopted after conference with eminent workers in the field of water supply and sanitation.

The standard of the International Joint Commission provides that in order to be suitable for filtration, without the imposition of an unreasonable burden upon the filter plant, a water should not show more than 50 per cent. positive tests for the organisms of the *B. coli* type when quantities of 0·1 c.c. are examined and the water analysed at frequent interval over a period of a year, in order to determine its seasonal variations.

The United States Treasury Department standard (given as U.S.T.D. in the tables) provides that the bacterial count at 37° C. on agar for 24 hours shall not exceed 100 per c.c., and that organisms of the *B. coli* group (as determined by lactose-broth fermentation, streaking on Endo's medium or litmus-lactose agar, and fermentation of lactose broth by colonies picked from the confirmatory plates) shall not be present in more than one out of five plantings of 10 c.c. amounts of the water. The media to be used and the processes to be employed are carefully specified. Provision has lately been made(^{4}) for placing more emphasis on sanitary surveys of water supplies than was contemplated when the standard was adopted as a limit of bacterial content of drinking waters. Thus, if a supply of water is found to be in an unsatisfactory sanitary condition, or subject to occasional danger, it is declared unfit in spite of the fact that an isolated analysis may have been satisfactory. If, as was suggested above, there is reason for qualified investigators to believe that the survey justifies a slight departure from the requirements of the standard, that may sometimes be countenanced.

It will, however, readily be seen that these standards do not apply to a water of the character mentioned by the book reviewer, either as satisfactory in its original form as a raw water, or in its finally purified form for a drinking supply. The writer has never heard of an instance in which the health authorities in America were satisfied that a water containing organisms of the *B. coli* group in 1 c.c. was safe for drinking purposes. It is sometimes impossible to secure a raw water which will come up to the specifications of the International Joint Commission, but such waters are recognised as demanding extra care and more careful supervision in their treatment.

As evidence that the statements made herein are of general applicability, the writer is submitting two tables which show, respectively, the attitude towards quality standards taken by the State Water Laboratories and that of the officials of individual water plants. All classes of practice are included; the modern and up-to-date type as well as the less modern. The tables are of necessity incomplete.* Special care has been taken to reproduce in each case, so far as possible, the statements of the persons responsible for the report. Attention is directed to the large proportion of water plants working up to the United States Treasury Department Standard, or to a more rigid one. All figures for gallons are given in U.S. gallons.

For further information concerning the operations of the water laboratories in America, the reader is referred to articles by Norton(^{5}), by Morse and Wolmann(^{6}), and by the writers(^{7,8}).

The reviewer of the book is of the opinion that the bacteriological tests given in the work he was considering are somewhat crude, and that they would include many non-intestinal microbes. In general they follow the "Standard Methods of Water Analysis of the American Public Health Association"(^{9}), which reflects the current practice in America. This publication recognises three types of confirmatory tests for the organisms of the *B. coli* group. In the first, known as the presumptive test, mere gas formation in lactose broth within 24 or 48 hours at 37° C. constitutes a positive test, if the gas production exceeds 10 per cent. of the capacity of the closed arm of the fermentation tube. In the second type of test, known as the partially confirmed test, streaks are made upon litmus-lactose agar or Endo's medium from all positive lactose fermentation tubes. If typical colonies develop after incubation at 37°, this test is called positive. The third type, or completed test, requires the fishing of two typical colonies, transferring each to an agar slant and a lactose-broth fermentation tube. The formation of gas in the lactose broth and the demonstration of non-spore-forming bacilli from the agar culture constitute a positive test. (Provision is of course made for carrying along the doubtful cultures.) Other tests, such as the Vosges-Proskauer and methyl-red tests, are authorised for further confirmatory work.

Small laboratories at water plants are often content with making only the presumptive test, and consider that the presence of gas is a positive test for the organisms of the *B. coli* group. Other laboratories carry the test further, using in some cases special broths, bile media, or eosine-methylene-blue agar plates. In every case, when the tests are adequately confirmed, the error is on the side of safety. Judging from his personal experience, the writer is of the opinion that there is somewhat greater uniformity of method among water analysts in the United States and Canada than among similar workers in Great Britain.

It is difficult to compare the results of analysts in different countries where different methods of examination are in vogue. This is true in chemical water analysis, as we are all aware, but the variation is even more apparent in bacteriological work, owing to the influence of the particular media involved, the periods and temperatures of incubation, and so on. The inhibitory effects of the media employed in one instance may be responsible for the fact that, apparently, the cruder methods of another locality may give results such that the supply under examination would be condemned or approved by both methods. Thus Bartow and Legendre(^{10}), working on chlorinated waters in France, agreed concerning the safety of the waters under investigation. Colonel Bartow was using the official methods of the American Expeditionary Forces, which were practically the same as the Standard Methods of Water Analysis of the American Public Health Association. M. Legendre employed the usual methods of the French water analyst, including bacterial counts on gelatin at 20° C. in 1, 2, 3, and 4 days; Vincent's phenol broth for *B. coli* group organisms, followed by confirmation on neutral-red glucose agar and litmus-lactose agar; and peptone water for the indol test.

The writer, working in another locality in

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* These tables have had to be curtailed.—ED.

Table No. 1.

STANDARDS OF THE STATE WATER LABORATORIES.

State.	Fixed standard.	Data used in interpretation.	Required examinations.	Required inspections.	Is U.S.T.D. standard reasonable ?	Remarks on U.S.T.D. standard.	Remarks.
Alabama ..	U.S.T.D... ..	—	4	1	Yes.	Great help in improvements.	
Arkansas ..	U.S.T.D... ..	—	2	2	—	Not to be used rigorously.	No routine chemical analysis.
California ..	—	—	—	—	Yes.	No single standard geo. applicable.	Rating should be based on percentage of time a supply meets or fails to meet a standard.
Connecticut ..	None	U.S.T.D.	6	—	—	—	General standard inapplicable.
Georgia ..	U.S.T.D... .. (Temporary)	—	Frequent	—	Yes.	—	Standards too severe just now.
Illinois ..	—	U.S.T.D.	—	—	Yes, except count.	—	
(Water survey)	—	—	—	—	—	—	
Indiana ..	None	U.S.T.D. for wells. More lenient to others ..	1	1	No.	—	Unconscious use of U.S.T.D. standard has raised quality but placed an unnecessary burden on many plants.
Iowa	None	—	2	—	Yes.	—	
Kentucky ..	None	—	—	—	(Severe.)	—	More emphasis on survey.
Maryland ..	None	Laboratory and field studies	Frequent	Frequent	—	—	No arbitrary standard desirable.
Michigan ..	—	—	—	2	Yes.	—	
Minnesota ..	Bacterial count on agar 96 hr. 20° C., less than 100 *B. coli* must not be present in 100 c.c.	Field survey always required, which may alter an arbitrary interpretation of the analysis in certain instances.	Frequent	Frequent	—	—	Standard entirely satisfactory.
Montana ..	—	No *B. coli* in treated water. Total count preferably below 50. If raw water over 1,000, 95-98% removal.	—	2	Yes.	Good. In some cases could be higher.	Chemical standards found impossible.
Nebraska ..	None	No colon in 10 c.c. for ground water. In surface water as few as possible.	1	—	—	Excellent goal. Cannot be met at all times.	Study of individual conditions better than a standard.
New Jersey ..	None	*B. coli* absent in 5 c.c. and good survey ..	4	Frequent	Yes, except count.	—	Few surface waters qualify as satisfactory raw waters by International Joint Commission standard.
North Carolina	None	*B. coli* in 1 and 10 c.c. undesirable. If present, followed by other exams.	12	—	—	—	Troubled by delays in shipment of samples.
North Dakota	U.S.T.D... ..	Chemical :— Good. Fair. Poor. Bad. Total solids .. 0-1000 -1500 -2000 -up Magnesium .. 0-75 -120 -175 -up Total hardness .. 0-400 -800 -1200 -up Chlorine .. 0-250 -600 -1200 -up Sulphates (SO_4) 0-250 -500 -1000 -up	—	—	Yes.	No difficulty.	
Ohio	None	Ground water : Less than 100 bacteria per c.c. ; 10 c.c. gas tubes all negative. Filtered water : Low count. 80% presumptive tests negative. Chlorinated water. Same as ground water.	—	—	—	—	Not prepared to set raw water standard.
Oregon ..	—	Less than 100 bacteria per c.c. "No gas in 72 hours."	12	—	—	—	Higher gas formation where human pollution excluded.
Rhode Island.	None	U.S.T.D.	424	1	—	Nearly all R. I. supplies meet U.S.T.D.	No standard can be applied to all classes of supplies.
South Carolina	None	Less than 200 bacteria per c.c. at 37° C. *B. coli* absent in five 1 c.c. and five 10 c.c. tubes.	4	2	—	Only 3 plants can meet U.S.T.D. standards.	Opposed to general standard.
Texas ..	—	U.S.T.D. or better.	2	—	Yes.	Easily maintained.	
Vermont ..	—	Absence of *B. coli* in 1 c.c.	—	—	—	—	Perfectly applicable.
West Virginia.	None	If survey is good :— .. .. Gas absent in 1, 10, 20 c.c. Safe. ,, ,, 1, 10 ; pres. in 20 c.c. Prob. safe. ,, ,, 1, present in 10 c.c. Suspicious. ,, present in 1 and 10 c.c. Unsafe.	12	—	—	U.S.T.D. as a goal.	Consider survey, time in shipment, and exam.

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Table No. 2.

STANDARDS OF PLANT OPERATION.

State.	City.	Capacity MGD.	Ownership.	Installed.	Source.	Treatment.*	Frequency of exams.†	Plant standard.	Remarks on standards.
Alabama ..	Mobile	24	M.	1887 ; 1900	Clear water creek	Hypochlorite	Weekly.	Advice Health Dept.	Valuable necessity.
Arkansas ..	Pine Bluff ..	3	P.	1907	Wells, 800-1,000 ft. ..	None	2 a month.	U.S.T.D. (100% time).	Bacteriologically U.S.T.D. standard too lenient. Should not attempt chem. standards.
California ..	Los Angeles ..	320	M.	1868	L. A. & Owens Rivers ..	Storage	Daily.	U.S.T.D. (Pract. 100% time).	Any standard demands exercise of judgment.
	Oakland, etc. ..	36	P.	1868	Lakes, wells, springs, etc...	$CuSO_4$; Al ; Cl. ..	Daily.	Maximum count 100 per c.c ; elimination of disease-producing forms.	
	Pasadena ..	12	M.	P. 1912	Surface, deep wells, tunnels	Cl (for surface)	Weekly.	Absolute elimination of *B coli*. in 10 c.c.	
	San Diego ..	12	M.	F. 1913	Reservoirs in mts. ..	Al ; Cl.	Daily.	U.S.T.D. (95% time).	Poss. a little rigid, but with reasonable co-operation can be met at least 80% of the time.
Colorado ..	Colorado Springs	22	M.	1878	Slopes of Pike's Peak ..	None	Daily(summer).	Less than 25 bacteria per c.c agar 37° C., 24 hrs.	Except limits for bact. counts and chem. contents, no set standard can apply to two diff. plants.
	Pueblo	—	M.	—	Arkansas River	Fe ; Li ; Cl.	2-3 a week.	Bact. count <100 per c.c., no red colonies ; no gas in 5 or 10 c.c. tubes in excess 20%.	
Connecticut ..	Hartford ..	30	M.	1854-1919	Mt. reservoir	Cl.	Daily.	Absence of *B. coli*, and normal chlorine.	
	New Haven ..	28	P.	1862	Storage reservoir ..	S.F. (part) ; Cl. ..	Daily.	Clear ; low colour ; bact. count under 50 ; negative *B. coli*.	
	New London ..	—	M.	1872	Reservoirs	None	Yearly.	Approval St. Bd. Health. Absence of polln. by exam. of watershed.	
	Stamford ..	7	P.	1871	Reservoirs	Cl.	2 a month.	Bacteria less than 50 per c.c. ; *B. coli* absent in 10 c.c.	
Delaware ..	Wilmington ..	24	M.	1903	Brandywine Creek ..	M.F. ; S.F. ; Cl. ..	Daily.	U.S.T.D. (adopted Nov., 1918).	
Dist. Columbia	Washington ..	68	U.S.	1853 ; 1905	Potomac River	Sed. ; S.F.	Daily.	Turbidity O ; Bact. on agar below 100 per c.c. ; *B. coli* in 10 c.c. very infrequent.	
Florida ..	Tampa	0·5	P.	1889	Springs and wells	Cl (spring)	Daily.	No *B. coli* in 10 c.c.	Overgrowth common in warm, chlorinated waters.
Georgia ..	Atlanta	21	M.	1893	Chattahoochee River ..	Co ; Al ; M.F. ; Cl. ..	Daily.	U.S.T.D. (99+% time). Total 37° C. bact. <20 ; *B. coli* absent in at least 2 out of 5 ten c.c.	Would be a burden to some plants.
	Savannah ..	16	M.	1853	Artesian wells	None	Weekly.		
Idaho ..	Boise	5	P.	1894	Open and artesian wells ..	None	Monthly.	U.S.T.D.	
Illinois . ..	Chicago	—	M.	—	Lake Michigan	Cl.	Daily.	Freedom from *B. coli* in 1 c.c. and 90% 10 c.c. plantings.	
	Evanston ..	12	M.	1873 ; 1913	Lake Michigan	M.F. ; Al ; Hy. ..	Daily.	U.S.T.D.	Have always furnished better water.
	Joliet	13·5	M.	—	Artesian wells	None	Daily.	Approval State Dept. of Public Health.	
	Peoria	34	P.	1889-02	Wells	None	Daily.	U.S.T.D. (100% time).	High count not always significant.
Indiana ..	Anderson ..	4	M.	1898	White River		Daily.	98% removal. 60 count. No gas.	
	Gary	18	P.	1907	Lake Michigan	Cl.	Daily.		U.S.T.D. standard reasonable.
	Indianapolis ..	60	P.	1876-1904	White River, 8 wells ..	Co ; S.F. ; Cl.	Daily.	37° C. count less than 100 per c.c. ; *B. coli* less than 10 per 100 c.c.	Not applicable to ground water or districts where summer temp. is practically blood heat.
	New Albany ..	5	P.	—	Ohio River	M.F. ; Cl.	Daily.	Approved State Board of Health ; turbidity O ; less than 100 bacteria per c.c. ; not more than an occasional trace *B. coli*.	Essential.
	Terre Haute ..	12	P.	1872	Wabash River	Sed. ; M.F. ; Cl. ..	Daily.	U.S.T.D. (100% time).	No special trouble maintaining U.S.T.D. standard.
Iowa	Burlington ..	6	P.	1904	Mississippi River	Sed. ; F. ; Cl.	2 a week.	U.S.T.D. (practically 100% time).	
	Council Bluffs ..	8	M.	1881-2	Missouri River	Sed ; Al ; Li ; Cl. ..	3 a week.	Turbidity 5 ; bacterial count less than 100 per c.c.	Standards for treated surface and underground waters should be different.
	Iowa City ..	2	P.	1882	Iowa River, galleries, wells	Al ; Li ; Sed ; M.F. ; Cl.	Daily.	Count less than 50 per c.c. 20° C. ; *Coli* absent in 10 c.c. ; turbidity O.	
Kansas ..	Kansas City ..	17·2	M.	1911	Missouri River	Co ; Sed ; M.F. ; Cl. ..	Daily.	U.S.T.D.	Reasonable, practical, adequate.
	Topeka	—	—	—	—	—	Daily.	Gas absent and count under 100 per c.c.	
Kentucky ..	Lexington ..	—	—	—	—	—	5 a month.		If gas formers present in summer, Bd of Health notifies public to boil water.
	Louisville ..	100	M.	1860	Ohio River	Al ; Sed ; M.F. ; Cl. ..	Daily.	U.S.T.D. Free from suspended matter	Maintained without difficulty in large plants. Doubts if can be maintained in small ones.
Louisiana ..	New Orleans ..	—	—	—	Mississippi River	—	Daily.	U.S.T.D.	Good.
	Shreveport .	10	M.	1887	Cross Bayou & Red River	Co ; Sed ; F. ; Cl. ..	Daily.	U.S.T.D. (practically 100% time).	Applicable.
Maine .	Lewiston ..	14	M.	1870	Lake Auburn	None	Monthly.		
	Biddeford, etc.	4·5	P.	1881	Saco River	Al ; M.F.	Daily.	Approval State Board of Health.	
Maryland	Baltimore ..	128	M.	1863-1915	Gunpowder River ..	Co ; M.F. ; Cl. ..	Daily.	U.S.T.D. (practically 100% time)	Minimum requirement probably too high where raw water contains large

	Stamford	7	P.	1871	Reservoirs	Cl.	2 a month.	Bacteria less than 50 per c.c.; B. coli absent in 10 c.c.	
Delaware	Wilmington	21	M.	1903	Brandywine Creek	M.F.; S.F.; Cl.	Daily.	U.S.T.D. (adopted Nov., 1918).	
Dist. Columbia	Washington	68	U.S.	1853; 1905	Potomac River	Sed.; S.F.	Daily.	Turbidity 0; Bact. on agar below 100 per c.c.; B. coli in 10 c.c. very infrequent.	
Florida	Tampa	9·5	P.	1889	Springs and wells	Cl (spring)	Daily.	No B. coli in 10 c.c.	Overgrowth common in warm, chlorinated waters.
Georgia	Atlanta	21	M.	1893	Chattahootchee River	Co; Al; M.F.; Cl.	Daily.	U.S.T.D. (93+% time). Total 37° C. bact. <20; B. coli absent in at least 2 out of 5 ten c.c.	Would be a burden to some plants
	Savannah	10	M.	1853	Artesian wells	None	Weekly.		
Idaho	Boise	6	P.	1894	Open and artesian wells	None	Monthly.	U.S.T.D.	
Illinois	Chicago	—	M.	—	Lake Michigan	Cl.	Daily.	Freedom from B. coli in 1 c.c. and 90% 10 c.c. plantings.	
	Evanston	12	M.	1873; 1913	Lake Michigan	M.F.; Al; Hy.	Daily.	U.S.T.D.	Have always furnished better water.
	Joliet	13·5	M.	—	Artesian wells	None	Daily.	Approval State Dept. of Public Health.	
	Peoria	34	P.	1889-92	Wells	None	Daily.	U.S.T.D. (100% time).	High count not always significant.
Indiana	Anderson	4	M.	1898	White River		Daily.	98% removal. 60 count. No gas.	
	Gary	18	P.	1907	Lake Michigan	Cl.	Daily.		U.S.T.D. standard reasonable.
	Indianapolis	60	P.	1876-1904	White River, 8 wells	Co; S.F.; Cl.	Daily.	37° C. count less than 100 per c.c.; B. coli less than 10 per 100 c.c.	Not applicable to ground water or districts where summer temp. is practically blood heat.
	New Albany	5	P.	—	Ohio River	M.F.; Cl.	Daily.	Approved State Board of Health; turbidity 0; less than 100 bacteria per c.c.; not more than an occasional trace B. coli.	Essential.
	Terre Haute	12	P.	1872	Wabash River	Sed.; M.F.; Cl.	Daily.	U.S.T.D. (100% time).	No special trouble maintaining U.S.T.D. standard.
Iowa	Burlington	6	P.	1904	Mississippi River	Sed.; F.; Cl.	2 a week.	U.S.T.D. (practically 100% time).	
	Council Bluffs	8	M.	1881-2	Missouri River	Sed; Al; Li; Cl.	3 a week.	Turbidity 5; bacterial count less than 100 per c.c.	Standards for treated surface and underground waters should be different.
	Iowa City	2	P.	1882	Iowa River, galleries, wells	Al; Li; Sed; M.F.; Cl.	Daily.	Count less than 50 per c.c. 20° C.; Coli absent in 10 c.c.; turbidity 0.	
Kansas	Kansas City	17·2	M.	1911	Missouri River	Co; Sed; M.F.; Cl.	Daily.	U.S.T.D.	Reasonable, practical, adequate.
	Topeka	—	—	—	—	—	Daily.	Gas absent and count under 100 per c.c.	
Kentucky	Lexington	—	—	—			5 a month.		If gas formers present in summer, Bd. of Health notifies public to boil water.
	Louisville	100	M.	1860	Ohio River	Al; Sed; M.F.; Cl.	Daily.	U.S.T.D. Free from suspended matter	Maintained without difficulty in large plants. Doubts if can be maintained in small ones.
Louisiana	New Orleans	—	—	—	Mississippi River	—	Daily.	U.S.T.D.	Good.
	Shreveport	10	M.	1887	Cross Bayou & Red River	Co; Sed; F.; Cl.	Daily.	U.S.T.D. (practically 100% time).	Applicable.
Maine	Lewiston	14	M.	1870	Lake Auburn	None	Monthly.		
	Biddeford, etc.	4·5	P.	1884	Saco River	Al; M.F.	Daily.	Approval State Board of Health.	
Maryland	Baltimore	128	M.	1853-1915	Gunpowder River	Co; M.F.; Cl.	Daily.	U.S.T.D. (practically 100% time).	Minimum requirement probably too high where raw water contains large numbers of non-fecal type B. coli.
Mass.	Brookline	5	M.	1874	Infilt. gallery and wells	(Fe and Mn removal)	Daily.		
	Cambridge	30	M.	1855	Impounded surface	None	Monthly.		
	Lynn	15	M.	1870	Impounded surface	None	Monthly.		V. sl. turbidity; colour 25; free NH_3 ·009; Cl 0·60; NO_2 and NO_3 0·0; hardness 2; colon 0.
	Met. Water Dist.	150	State	1898	Impounded surface	None	Daily.	To furnish safe, colourless, attractive water.	
Michigan	Battle Creek	18	M.	1887	Lake and wells	Cl.	2 a month.	130 bacteria per c.c.; no gas in 5 c.c.	Good as far as they go.
	Detroit	200	M.	1829	Detroit River	Cl.	Daily.		
	Grand Rapids	20	M.	1913	Grand River	Li (softening)	Daily.	U.S.T.D.	No local difficulty with U.S.T.D. As far as practical there should be Govt. standard.
	Kalamazoo	4	M.	1849	Wells, 120-150 ft.	None	6 a year.	Approval of State Laboratory.	
Minnesota	Minneapolis	90	M.	1868-1913	Mississippi River	Sed.; Co.; F.; Cl.	Daily.	B. coli absent from 100 c.c.; Colony count on agar 20° C. less than 100 per c.c.	U.S.T.D. reasonable. Plant standard can be attained by proper construction and operation.
	St. Paul	43	M.	1869	Chain of lakes, wells	$CuSO_4$; Cl.	2 a week.	B. coli absent from 100 c.c.; Colony count on agar 20° C. less than 100 per c.c.	Nature and source of supply should govern standard adopted. U.S.T.D. reasonable.
Mississippi	Jackson	4	M.	1914	Pearl River	Al; Li; F.	Daily.	Average count below 10 per c.c.; low turbidity; complete reaction.	Probably difficult with majority of river waters.
Missouri	St. Louis	160	M.	1834-1915	Mississippi River	Sed; Al; Fe; Li; M.F. Cl.	Daily.	U.S.T.D. (100% time). Agar count 37° C. less than 50 per c.c. No B. coli in 1 or 10 c.c.	"No convincing argument for plaintiff in the case of Economy versus Health."
Montana	Butte	13	P.	1892	3 mountain streams	$CuSO_4$; Li; Cl. (on 2)	Monthly.	U.S.T.D.	Highest standard possible should be maintained.
	Great Falls	12	M.	1916	Missouri River	Fe; Li; M.F.; Cl. (?)	Daily.	U.S.T.D.	Do not believe any general rule could be made unless very low standard.
Nebraska	Omaha	50	M.	1886	Missouri River	Sed; Al; Cl.	Daily.	No B. coli; turbidity less than 3.	
New Hamp.	Manchester	28	M.	1872	Lake Massabesic	None	Monthly.	U.S.T.D.	
New Jersey	Atlantic City	40	M.	1882	Absecom Cr. & art. wells	Cl. (surface)	4 a year.	U.S.T.D.	
	Jersey City	50	M.	1905	Rockaway River, Boonton Res.	Hy; Cl.	Daily.	U.S.T.D.	Satisfactory as a whole.
	Trenton	30	M.	1914	Delaware River	M.F.; Cl. (?)	Daily.	Not over 1 p.pm. turbidity; 15 colour; not over 5% pos. B. coli in 10 c.c. tests.	Difficult to make a standard that would be accepted and lived up to. General averages count.
New York	Albany	32	M.	1900	Hudson River	Sed; Ca; M.F.; S.F.; Cl.	Daily.	Bact. at 20° C. <50; at 37 <25; no acid on neutral red bile agar; no B. coli in 10 c.c. tests.	No rigid standard is applicable to all watershed conditions.
	Buffalo	330	M.	1827	Lake Erie & Niagara R.	Cl.	Daily.	Moderate number of bacteria; absence of B. coli.	
	New York	800	M. & P.	1842	Surface and wells	Cl.	Daily.	Absence of noticeable turbidity, colour, odour; prevention and destruction of troublesome micros. organisms.	Believe it is utterly impossible to establish standards of general application.
	Niagara Falls	16	M.	1912	Niagara River	Ca; F.; Cl.	Daily.	Count on gelatin less than 25 per c.c.; B. coli negative in 10 c.c.	Quite satisfactory.
	Rochester	33	M.	1872-4	Lakes	None	4-5 a month.		
	Schenectady	32	M.	1897	Wells	None	Yearly.	Chemical purity by analysis.	
	Syracuse	27	M.	1892	Skaneateles Lake	Cl. (rarely)	2 a week.	U.S.T.D.	
	Troy	57	M.	1834-1914	Storage Res.	$CuSO_4$ (when necessary)	2 a week.	Clear water, free from injurious bacteria, and free from disagreeable taste and odour.	
N. Carolina	Wilmington	6	M.	1882-1911	Cape Fear River	M.F.; Cl.	Daily.	Absence of B. coli in 90% 10 c.c. tubes. Median of counts below 10 per c.c.	Difficult to make a standard applicable to all conditions.
Ohio	Cincinnati	112	M.	1907	Ohio River	Fe; Li; Ca; Sed; M.F.; Cl.	Daily.	Total bact. count not over 100 per c.c. B. coli not to exceed 5 per 100 c.c. Under exceptional conditions B. coli may exceed 100 per c.c.	A fixed standard cannot be adhered to in all cases. Some elasticity and discretion necessary.
	Cleveland	250	M.	1854-6	Lake Erie	Filt. (60%); Cl.	Daily.	Potable temperature excepted, free from injurious effect on the human body; reasonably free from objectionable smell, taste, and from objectionable salts in solution.	If a standard is adopted for general application it must be one which can be met by every water company. Then it would have to be so broad and liberal as to have no real value.
	Toledo	5·6	M.	1873	Maumee River	Fe; Li; Al; Cl.	Daily.	U.S.T.D.	
Oklahoma	Oklahoma City	12	M.	1893	N. Canadian River	Co; M.F.; Cl.	Daily.	U.S.T.D.	Minimum for any treated supply.
Oregon	Portland	66	M.	1895	Bull Run Lake and River	None	2 a month.		(Bact. count about 4 per c.c. No coli.)
Pennsylvania	Allentown	15	M.	1869 P	Springs	Cl.	Daily.	Bacteria below 25 per c.c.; no B. coli in 100 c.c.	Should be condemned if not up to this standard.
	Erie	24	M.	1867-1914	Lake Erie	M.F.	Daily.	Complete removal of suspended matter. Colour less than 10. B. coli absent in all 1 c.c. plantings.	Possibly too high to be generally applied.
	Philadelphia	—	M.	—	Delaware and Schuylkill Rivers.	Filt.	Daily.	U.S.T.D.	Reasonable.
	Pittsburgh	—	M.	1907	Allegheny River	S.F.; Cl.	Daily.		No reasonable standard. "Hire a man who is capable of judging conditions and throw rule-of-thumb methods away."
Rhode Island	Providence	30	M.	1871	Pawtuxet River	S.F.	Daily.	B. coli absent in 10 c.c.	
S. Carolina	Charleston	6	M.	1902	Goose Creek	Al; Co; Sed; F.; Cl.	Daily.	Franchise reg.: Removal of 85% susp. matter; 80% of colour; 85% alb. NH_3 in suspension; 97% bacteria when over 3,000 per c.c. in raw water; when raw water <3,000, treated <100 per c.c. 85 p.pm. NaCl; total solids (minus NaCl) not over 75 p.pm. No objectionable odour or taste.	Reasonable and safe standards should be adopted. Occasional high counts not significant.
Tenn.	Memphis	30	M.	1890	Deep wells		Daily.	Less than 5 bacteria per c.c.	Chief difficulty Fe and CO_2.
	Nashville	20	M.	1835-1882-90	Cumberland River	Al; Co; Sed; Hy.	Daily.		U.S.T.D. standard generally reasonable. Should be adopted as an ideal even in localities where attainment is imposs.
Utah	Salt Lake	40	M.	1873	3 mountain streams	Cl. (part)	Weekly.		
Virginia	Newport News	8	P.	1892	Impounded surface	Filt.; Cl.	Daily.	Less than 10 bacteria per c.c. on agar. No gas in 10 c.c.	Applicable where raw water is impounded.
Washington	Tacoma	42	M.	1822-1909	Green River	Cl.	5 a week.	Bacteria less than 20 per c.c.	
W. Va.	Charleston	14	P.	1908	Elk River	Li; Al.	Daily.	99% pure.	
Wisconsin	Kenosha	18	M.	—	Lake Michigan	Al; Co; F.; Cl.	Daily.	98% pure.	
	Madison	7·5	M.	1883	Deep wells (Potsdam ss.)	None	Monthly.	Bacteria not over 10 per c.c.	Must consider source of supply.
	Milwaukee	106	M.	1874	Lake Michigan	Cl.	Daily.	See Cleveland, Ohio.	Impractical to fix general standard. Would have to be so low as to be of no real value.
Alberta	Edmonton	6	M.	1910	N. Saskatchewan R.	Sed; F.; Cl.	Daily.	Bacteria less than 10 per c.c.	
Brit. Columbia	New Westminster	7	M.	1892	Coquitlam Lake	None	4 a year.		Standards would be useful.
Ontario	St. Catherine's	10	M.	1871	Lake Erie	Ae; Sed; Cl.	Weekly.	Absence of colour, taste, odour. Low count. B. coli absent in 10 c.c.	Seems to work all right.
	Toronto	—	M.	1841-1912-6	Lake Ontario	Al; M.F.; S.F.; D.F.; Cl.	Daily.	Water bright and clear. Bacteria less than 10 per c.c. agar 37° C.; B. coli absent in 10 c.c.	Well conducted plants should be able to meet these requirements.
	Ottawa	40	M.	—	Ottawa River	Chloramine	Daily.	B. coli absent in 50 cc. tests	
Quebec	Montreal	30	P.	1912	St. Lawrence River	M.F.; Cl.	Daily.	Low bacterial count. Absence of B. coli in 10 c.c.	"The more I see and hear of so-called standards for water, the less I think of them."

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* Ae=Aeration; Al=Aluminium sulphate; Fe=Iron sulphate; $CuSO_4$=Copper sulphate; Li=Lime; F. or Filt.=Filtration, kind not specified; M.F.=Mechanical or Rapid Sand Filtn.; S.F.=Slow Sand Filtn.; D.F.=Drifting Sand Filtn.; Sed=Sedimentation; Co=Coagulation; Cl=liquid Chlorine. Hy=Calcium hypochlorite.

† Daily=One or more times per day.

J. J. HINMAN, Jr.

France, carried out daily analyses on the supply of the city in which he was stationed. These analyses were continued for a period of a little over three months. At the same time similar work on the same supply was being done by a French military laboratory and a French civil laboratory. There was close agreement in the interpretation of the results of the analyses.

Unfortunately the writer's work in England was such that a similar check of results could not be carried out there, for his work was largely confined to single inspections and single sets of samples. In most cases there was no special discrepancy between his interpretations and those of the British analysts entrusted with the examination of the supplies investigated, judging from conversation with the analysts themselves, or from their reports, when these were shown to him. It would be interesting to see the results of an examination carried out by English and American analysts, each using the methods to which he was accustomed and both working upon a supply of variable character. Perhaps the work of Race, at Ottawa, or of Howard, at Toronto, might provide a near approach to this comparative work. The writer feels certain that there would not be any such wide variation of practice as has been indicated in the review. He is sure that "if the raw water contained, say, *B. coli* in 0·001 c.c. and in the final effluent this was reduced to a positive result with 1 c.c." American water-supply workers would not by any means be satisfied with the safety of the water.

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[1] D. B. Byles, Review of "Water Purification Plants and Their Operation," by Milton F. Stein, J.S.C.I., Vol. XL., No. 8, p. 159R (April 30, 1921).

[2] Final Report of the International Joint Commission on the Pollution of Boundary Waters, Washington, 1918, p. 14.

[3] United States Public Health Reports, Vol. 29, No. 45, p. 2959 (November 6, 1914).

[4] Amendment No. 8 to U.S. Interstate Quarantine Regulations, July 14, 1919.

[5] J. F. Nortoo, "A Comparison of the Methods for the Examination of Water at Filtration Plants," Journal of Infectious Diseases, Vol. 23, p. 344 (1918).

[6] R. B. Morse and A. Wolman, "Practicability of Adopting Standards of Quality for Water Supplies," Journal of the American Water Works Association, Vol. 5, p. 198 (1918).

[7] Jack J. Hinman, Jr., American Water Works Laboratories, Journal of the American Water Works Association, Vol. 5, p. 133 (1918).

[8] Jack J. Hinman, Jr., Standards of Quality of Water, Journal of the American Water Works Association, Vol. 7, p. 821 (1920).

[9] Standard Methods for the Examination of Water and Sewage, American Public Health Association, 4th Edition, Boston, 1920.

[10] Bartow and Legendre, La Chloration, Masson et Cie., Paris, 1918.

THE DESTRUCTION OF RATS BY CHEMICAL MEANS.*

C. L. CLAREMONT.

Only recently has the problem of rat destruction been seriously considered in Great Britain. Its importance cannot be gainsaid. The material damage caused by rats in this country was estimated to be £2,000,000 in 1909, and in India the total losses, including those due to plague, were evaluated at £828,000,000 over a period of twenty years. A rat population of 10 million pairs would number over 41 million pairs at the end of twelve months, allowing for death and other wastage, and the cost of maintenance, at ¼d. per day per rat, would be over £9,000,000 per annum. Further, the rat is a notorious carrier of disease; through the parasites which it harbours it gives rise to plague, trichinosis, rat-bite fever, and spirochaetal jaundice, and the dissemination of other diseases has also been attributed to it.

For some years the Vermin Repression Society carried on vigorous propaganda, but it was not until war conditions rendered the problem even more pressing that the Government took action, which resulted in the formation of a Rats Branch of the Board of Agriculture and Fisheries and the passing of the Rat and Mouse Destruction Act of 1919. In the following year a research laboratory was established together with a small factory for supplying raticides for use on Government premises. The work of the laboratory, which has only recently been started, has been the chemical examination of proprietary and other rat poisons, and the investigation of materials believed to contain such poisons, experiments on live rats being undertaken when necessary.

Of the methods in use for destroying rats, hunting and trapping are obviously of limited application. The virus method, *i.e.*, infecting with disease, is uncertain; the susceptibility of rats varies, sub-lethal doses tend to immunise them, and the virus, by its passage through the rat, may become more virulent and therefore more dangerous to human beings. Poisoning is undoubtedly the best method, and "gassing" is one of the most effective, for it kills the females and their young in the nests. Hydrocyanic acid and carbon bisulphide are very deadly, but as the former is colourless, its use is dangerous even to skilled operators, and the latter is very inflammable. Chlorine and phosgene are somewhat dangerous for general use, and have to be stored compressed in cylinders, which are difficult to transport. Sulphur dioxide is best; it is easily handled as liquid, can be prepared on the spot by burning sulphur, and is not too dangerous, as its odour will warn the operator when the concentration is becoming too high. A mixture of sulphur dioxide and sulphur trioxide is stated to be more toxic and to kill not only the rat, but also its parasites.

Of the solid poisons, phosphorus, arsenic, and strychnine must be ruled out as too dangerous. The *desiderata* of a good rat poison are:—Relative harmlessness to domesticated animals; cheapness and availability; effectiveness; absence of a repellent taste; it must be easy and clean to handle and readily incorporated in the bait; and it should be stable. There are not many poisons which satisfy all these conditions, but those which most nearly do so are barium carbonate and Red Squill (*Scilla maritima*). Barium carbonate is rather more toxic to other animals than is desirable, and the disadvantages of Squill are that the bulbs irritate the hands (thick leather gloves should be used), the preparations do not keep well (a defect which will probably soon be overcome), and the supply in this country has been irregular. Although the lethal doses of barium carbonate for many domesticated animals are known, the information concerning Squill is very scanty, but, assuming the figures given by Abderhalden to be correct, it is probable that 10·66 grains would kill a rat weighing 0·5 lb., and 77 grains of the bulb would kill a dog of 10 lb.

Successful poisoning naturally depends upon the nature and size of the bait employed. Experiments have shown that baits should weigh from 30 to 60 grains and contain the following percentages of toxic agent:—Barium carbonate, 25 per cent., or 7½ grains in 30 gr. of bait; Squill bulb, 20 per cent., or 10 gr. in 50 gr. of bait; Squill powder, 20 per cent., or 5 gr. in 25 gr. of bait; arsenic, 5 per cent., or 1 gr. in 20 gr. of bait.

The bait should be ready for use and easy to handle, operations such as spreading on bread, etc. being undesirable. It should be capable of being applied without excessive handling and in such a form that the amount required can easily be ascertained. Also, the bait should be attractive and freshly prepared; and each toxic agent should be used in a variety of baits, so that if one kind is not eaten another can be employed. The best general vehicle is a mixture of oatmeal and fat in the form of a hard paste, variety being obtained by the use of fish or cheese; or the poison can be mixed with flour and made into small biscuits with various additions. For mice, coarse powders similar to the paste for rats but with much less fat are recommended; three kinds are made, viz., plain, cheese, and fish. Squill preparations are prepared in a similar way, either chopped bulb or powder being used; biscuits and cake with cheese are the most useful forms. Only one Squill paste is made, but being uncooked it is only suitable for immediate use. Squill is also prepared in the form of liquid extract. Baits containing no fish or cheese, and therefore without odour, should be slightly flavoured with aniseed.

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* Based on a paper entitled "National Research on Rat Destruction," read before the Royal Sanitary Institute, at Folkestone, on June 24, 1921.

SOCIETY OF CHEMICAL INDUSTRY.

Messrs. E. F. Armstrong, J. Allan, J. W. Hinchley, and W. J. U. Woolcock have been elected members of the Council at the annual meeting held in Montreal.

PERSONALIA.

The McGill University, Montreal, has conferred the degree of Doctor of Laws on Sir William Pope.

Prof. C. S. Sherrington, president of the Royal Society, has been elected president of the British Association for the year 1922–23 (Hull Meeting).

Dr. H. Lee Ward, formerly of the National Chemical Co., has been appointed assistant professor of chemistry at Washington University, St. Louis.

Mr. B. A. Keen, head of the Soil Physics Department at Rothamsted, has been awarded a travelling fellowship by the Ministry of Agriculture and has left for the United States.

The Secretary of State for the Colonies has appointed Sir C. H. Bedford to be his honorary adviser on questions relating to power and industrial alcohol in the Colonies and Protectorates.

Prof. R. A. Millikan, of the University of Chicago, has been appointed director of the new Norman Bridge Laboratory of Physics at the California Institute of Technology and chairman of the executive council of the Institute.

Mr. W. G. Campbell, assistant chief of the United States Bureau of Chemistry, has been appointed acting chief in place of Dr. Alsberg, now director of the Food Research Institute at Stanford University, California, and Dr. W. W. Skinner has become assistant chief.

On the occasion of the Edinburgh meeting of the British Association for the Advancement of Science the Senate of Edinburgh University has conferred the honorary degree of Doctor of Laws upon Sir E. Thorpe, Sir O. Lodge, Dr. Irving Langmuir, of New York, and Prof. Arrhenius, of Stockholm.

Prof. F. Dupré, professor of chemistry at the Royal Technical Institute at Pesaro, died on July 20.

Mr. L. A. Fischer, physicist and chief chemist of the Division of Weights and Measures of the United States Bureau of Standards, died on July 25 at the age of 57.

NEWS AND NOTES.

UNITED STATES.

Research on Lignite.—An arrangement has been made between the Bureau of Mines of the United States and the corresponding institution of Canada for the exchange of information relating to research on lignite, and it is hoped that in the future such research will be carried out conjointly. In this way much duplication of effort and expense could be avoided.

Research Chemicals.—A course in the manufacture of organic chemicals is being given during the summer by the chemistry department of the University of Wisconsin in order to reduce the cost of research chemicals needed in the scientific departments of the University. Eight advanced students have been admitted to the course and will be paid 40 cents an hour for their work which, whilst providing for the needs of the University, will give them an intensive training in practical organic chemistry and experience in larger-scale operations.

Manufacture of Anthraquinone.—One of the drawbacks to the production of vat dyes, of which 1786 long tons is consumed annually in the United States, has been the high cost of making anthraquinone by the oxidation of anthracene with dichromate in acetic acid solution; to which may be added the lack of demand for the hard pitch which remains after the anthracene has been extracted from the tar. These dfficulties, it is believed, will be overcome by the Thatcher process, which is electrochemical and involves the use of a special type of cell, and by means of which the daily production of 1000 lb. of anthraquinone has now been started.

Fuller's Earth in 1919.—The activity recorded in the fuller's-earth industry in the United States during 1918 (*cf.* J., 1919, 456 R) continued throughout 1919, following the upward trend of petroleum production. Alabama, Florida and Texas were the chief producing States, and the total output was 106,145 short tons valued at $1,998,829, an increase of 26 per cent. in quantity and nearly 75 per cent. in value. Prospects for increased output seem good, and many new developments may take place shortly, particularly on the Pacific Coast, where large deposits of excellent material have been found. The average selling price—$18.83 per short ton—was the highest on record. Imports of fuller's earth, mainly prepared material, amounted to 13,873 tons, valued at $189,711 (increase over 1918, 1266 t.), and exports to about 1400 tons.—(*U.S. Geol. Surv., Mar.* 9, 1921.)

SOUTH AFRICA.

Rhodesia in 1920.—In his report for 1920, the Director of Agriculture of Rhodesia states that the oil factory at Salisbury is re-starting, and that it is proposed to extract oil from maize and to prepare cattle cake and meal from the by-products of the maize-milling industry. The whole of last year's cotton crop was dealt with by the new ginnery, bales of raw cotton were prepared for export and seed for oil extraction. Fibre, particularly Deccan hemp (*Hibiscus cannabinus*), is being sold to the Northern Rhodesia Fibre Co. and the Barberton Jute Co., and the manufacture of sacks, etc., has been started at Umtali. A new industry has been started by the Rhodesia Leather Co., Ltd., which has established a tannery and is preparing hides and skins both for local use and for export. Fertiliser production has been increased by the exploitation of the bat-guano deposits found in several localities in the Hartley, Lomagundi, and Victoria districts. The dairying industry is making great progress.

AUSTRALIA.

Industrial Notes.—*The National Research Council.*—The first session of the Australian National Research Council was opened at Melbourne on August 23, under the presidency of Prof. Sir Edgeworth David.

The Sugar Crop in Queensland.—The sugar-cane crop in Queensland amounts to over 2 million tons, yielding 250,000 t. sugar, the second highest yield ever recorded.—(*Official.*)

The Coal-tar Dye Industry.—It is announced that a small but well-equipped factory for the manufacture of coal-tar dyes will start operations shortly in Melbourne. When complete the plant will employ 250—300 persons as well as a staff of chemists, and it is hoped that the output will be 150 tons in the first year and that within two years the whole of the Australian requirements will be met. Acid, basic, chrome, alizarin, nigrosine and other dyes are to be made, and up to the present a range of fast colours comprising 54 different shades has been proved.—(*U.S. Com. Rep., Aug.* 5, 1921.)

Experiments in Paper-Making.—Owing to the present shortage and high price of paper in Australia, considerable interest has been taken in the utilisation of local timber for producing newsprint paper, but so far without success. Now, however, the Forest Products Laboratory claims that newsprint paper equal to the best Scandinavian product can be produced from Karri waste obtained from timber mills. The breaking strain of this paper is stated to be 1·2 per cent. greater than that of the Scandinavian product and the production cost is estimated at £12 per ton. Enormous quantities of Karri waste are obtainable at a nominal cost. The Laboratory is acquiring a 5-ton digestor in order to obtain more accurate costings, and should these prove satisfactory it is announced that some of the large newspaper companies will provide money to establish the industry on a suitable scale. Paper has also been made in the Laboratory from bleached and unbleached pulp obtained from the silky oak, mountain gum, spotted gum, blackbutt, and mountain ash. Mountain-ash pulp is said to make paper suitable for ledgers, etc., and supplies of this timber in Victoria are more than sufficient to meet the requirements of the whole Commonwealth.—(*Bull. Dept. Tr. Com., Can., July* 11, 1921.)

CANADA.

The Glass Industry in 1918.—During 1918, nine establishments (7 in Ontario, 1 in Quebec, 1 in Alberta) with a total working capital of $7,443,525, were engaged in the manufacture of glass and glassware in Canada. The value of the output at the factories was $6,578,602, so that, with exports and imports worth $35,267 and $5,430,873, respectively, the Canadian production met only 54.9 per cent. of the domestic demand. There were 117 salaried workers and 2215 plant workers, the total earnings of each class being $210,512 and $2,011,051, respectively. The fuel consumed comprised 46,651 t. of bituminous coal worth $352,293, and 733,653 cb. ft. of gas worth $146,593, including $145,804 paid for 729,906 cb. ft. of natural gas in Ontario and Alberta. Materials used cost $2,056,739, and included soda ash 13,468 short tons ($635,068), glass or silica sand 40,344 t. ($155,854), litharge and red lead 169,987 lb. ($17,764), etc. Amongst the products manufactured were lamp chimneys, bottles, and other pressed and blown glassware made by six firms; vials and chemical glassware from two firms; and window glass from one firm. The extension of the Canadian glass industry appears to be feasible, as the necessary raw materials are present in abundance and the market is already developed.

The Soap Industry in 1918.—According to a report issued by the Dominion Bureau of Statistics, the 28 soap factories in Canada, including 13 in Ontario, manufactured over 44,650 long tons of soap in 1918, and sales were valued at over $13,000,000. Imports of soap included washing soap 2232 t., soap powders 357 t., and toilet soaps worth $592,000, the total value being over $1,000,000. As exports are valued at about $100,000, there appears to be scope for an extension of the Canadian soap industry.

INDIA.

The Development of Chemical Industry.—The address read by Dr. E. R. Watson at the Indian Science Congress on February 1, which was noticed briefly in this Journal (1921, 121 R), is published in full in the May issue of the *Journal of Indian Industries and Labour*. From a consideration of the available data it appears that, as far as benzene and toluene are concerned, India could undertake the manufacture of explosives, drugs, and synthetic dyes. Requirements in sulphuric acid will probably be met from a zinc-smelting works at Jamshedpur which it is proposed to erect, and the alkaline soils of India could furnish ample supplies of alkali. There seems no reason to doubt that the production of industrial alcohol is feasible, although the future of wood-distillation is uncertain. Questions such as the manufacture of sulphuric acid from sulphates, the survey of alkaline soils in India, and the production of aromatic compounds from sources other than coal-tar and coke-oven by-products need immediate investigation, and many other chemical problems of lesser importance are awaiting solution. Thus research is required on the utilisation of lac-dye which, although an anthraquinone derivative, is thrown away as it is not sufficiently fast to alkalis, and on the conversion of pinene, which can be obtained cheaply and in any quantity from Indian turpentine, into the unsaturated open-chain compounds which are the chief constituents of essential oils and perfumes.

FRANCE.

Industrial Notes.—*Metallurgy.*—The price of German metallurgical coke for use in blast furnaces, etc., has been reduced to 75 fr. per metric ton delivered at the French frontier, whereas French coke is selling at 100 fr. per ton delivered at the works; taking the cost of carriage into account, factories in eastern France will thus pay about 15 fr. less for coke than factories in the north, west and south. Foundry coke, however, is still quoted at 150—155 fr. per ton, but it is considered that the difference between the prices of foundry and metallurgical coke should not be more than 20 fr. This reduction in the price of coke will probably not affect metallurgical prices, and will only tend to reduce the abnormal difference now existing between cost and selling prices. It is reported that the Government intends to ask the railway companies to increase the rebate of 25 per cent. allowed on rail rates for all metallurgical products for export. The object of this policy of reducing costs is to assist the export trade to meet German competition, which is increasing to such an extent that prices on the German market have risen. A federation of metallurgical, mechanical, and electrical constructors has been formed in Paris under the name of "La Fédération Méchanique." The federation, which comprises about 3000 factories employing some 400,000 workmen, has the following aims:—To defend the interests of the metal-using industries; to study economic questions relating to those industries; to obtain raw materials under the most advantageous conditions; and to organise exportation.

Coal.—Remarkable efforts have been made by the mines in the devastated areas of the Nord and Pas de Calais districts to increase their output, which attained 3,266,000 tons in the first six months of 1921, compared with 750,000 t. in the same period of 1920, an increase of 335 per cent. The total output of the Nord and Pas de Calais coalfields in the first six months of 1921 was 7,344,000 t., as against 3,810,000 and 14,946,000 t. in the same period in 1920 and 1913, respectively.

Chemical Industry.—Owing to the break of the drought, sales of fertilisers have increased, and nitrates are in keen demand as ammonium sulphate is in short supply. From tests made by the Syndicate of Sugar Producers it appears that the average weight of the sugar beet is 343 grm. (797 grm. in 1920), the yield of roots per hectare 10,430 kg. (18,171 kg.), and the weight of sugar per root 28·14 grm. (38·08 grm.), whilst the sugar content is 17·16 per cent., compared with 13·75 per cent. in 1920. The price of salt has risen as the abundant rainfall on the sea-coast has completely stopped production.

Utilisation of Tidal Energy.—After two years of study, the commission appointed by the Ministry of Public Works has reported favourably on the scheme put forward by "La Société Financière pour l'Industrie" for harnessing the tidal energy in the estuary of the Aber-Vrach (Finistère). The installation, which will cost 200,000 fr., will develop 1600 h.p. (which could be increased to 4800 h.p.), producing 11 million kw. per annum, equivalent to 16,500 t. of coal.

Mineral Production in 1920.—Statistics of the French output of minerals in 1919 and 1920 are given below:—

	1920.	1919.
	Metric tons.	
Salt	826,556	660,217
Potash:—		
Crude (12–16% K_2O)	646,854	—
Manure salts (20–22% K_2O)	330,543	—
Chloride (over 50% K_2O)	62,239	—
Total K_2O	192,486	98,715
Mineral oils	46,072	31,163
Asphalt	22,252	11,065
Bauxite	186,693	163,447
Iron pyrites	132,443	118,703
Iron ores	13,871,187	9,429,789
Coal	24,303,228	21,567,009
Coal (Saar Basin)	9,410,433	—
Lignite	971,076	909,757
Ores:—		
Auriferous	4,137	10,224
Copper	373	—
Lead	4,808	2,211
Zinc	4,247	7,293
Lead and zinc	1,247	1,859
Manganese	5,697	4,815
Antimony	3,880	3,255
Arsenic	532	2,261
Tin	20	—
Tungsten	6	33

The number of workers employed in and about the coal mines was 224,468 (176,072 in 1919). Of the total output of salt in 1920, Lorraine produced 29,716 t. of refined salt and 89,288 t. of industrial salt.—(*Tech. Mod., May*, 1921.)

Mineral Production in Algeria.—Considerable progress was made in the Algerian output of minerals in 1920, and but for the trade crisis that supervened at the end of the year the figures would have been still more favourable. The output of the chief minerals in 1919 and 1920 is given below:—

	1920.	1919.
	Metric tons.	
Phosphates	334,704	242,186
Iron ores	1,114,438	782,805
Copper ore	601	1,000
Lead ore	12,804	8,318
Zinc ore	12,804	8,318
Antimony ore	2,966	4,261
Mercury, native	0·2	8·1

The total value of the mineral output in 1920 was 78 million fr., as against 52 million fr. in 1919. Except for 9794 t. lead and 2346 t. antimony, the whole production was exported. The department of Constantine furnished all the phosphate and lead ore and five-sixths of the zinc ore, and three-fifths of the output of iron ore came from the department of Oran.—(*Tech. Mod., May*, 1921.)

JAPAN.

The Sulphuric-Acid Industry.—Great progress was made by the Japanese sulphuric-acid industry during the war, and at its close in 1918 there were 38 factories, representing a total capital of £8,544,162 (yen=2s. 0½d.) and employing 2113 workmen. The output from 1914 to 1918 was as follows:—

	Long tons.	£
1914	211,118.3	309,439
1915	219,654.8	484,375
1916	348,850.7	1,117,021
1917	546,776.0	1,520,584
1918	569,830.6	2,003,167

In 1918 the production consisted of 120,387 tons of chamber acid, 26,741·3 t. acid of 60° Bé., 16,688 t. of 65° Bé., and 40,810 t. acid of 66° Bé. The raw materials used in that year included:—Pyrites 327,008 t. (25,535 t. zinc blende), nitre 5177 t., and coal 33,271 t. The home consumption of the acid amounted to 499,900 t., of which 9800 t. was used for making Glauber's salt, 500 t. for soda ash, 14,800 t. for caustic soda, 72,800 t. for ammonium sulphate, 270,400 t. for superphosphate, 5900 t. for nitric acid, 5300 t. for sodium sulphide, and 120,400 t. for petroleum refining, dyestuffs, and celluloid. Values and quantities of the exports during the period 1914—1919 are given below:—

	Long tons.	£
1914	2,015.9	14,455
1915	7,884.4	51,698
1916	14,886.3	156,315
1917	4,136.4	51,866
1918	3,489.3	42,170
1919	3,153.3	44,908

In 1919 China took 33·5 per cent. of the exports of sulphuric acid, Dutch East Indies 25·9 per cent., Straits Settlements 16·5, Hongkong 11·9, Philippines 5·9, Manchuria 33·5, Siberia 0·9, and Siam 0·3 per cent. At present the demand is very limited and output has had to be reduced; China, which took over 4464 t. in 1920, is the only market remaining unchanged. The price of the acid varies from 1·2 to 6 sen per lb. of acid of 50—66° Bé., or slightly more than double the pre-war price (sen = 0·245d. at par, now about 0·311d.).

GENERAL.

Tungsten (1913—1919).—The Imperial Mineral Resources Bureau issues under the above title (H.M. Stationery Office. 1s. net) authoritative statistics relative to the world's production of ores of tungsten during the period named and includes useful data concerning the occurrence in the producing countries and further possible sources of supply. An outstanding feature is the production of China, which rose from 20 tons in 1914 to over 10,000 tons in 1918; an amount in excess of the whole world's production in 1913.

The pre-war value of concentrates containing 65—70 per cent. WO_3 was about 28s. per unit. In 1917, under an arrangement with the Home Government, British Imperial supplies were paid for at the rate of 60s. per unit. The present price (September, 1921) is about 13s. c.i.f. European ports.

TNT as an Industrial Poison.—In 1918 the American National Research Council, the U.S.A. Department of Labour, the Public Health Service and the War Department organised an investigation of the conditions of TNT poisoning. This problem, as is well known, has already received the attention of British investigators and of scientists in other belligerent countries. The American workers intended mainly to settle some of the controversial points. Like the earlier workers, they found that TNT is chiefly absorbed through the skin. Fumes are also capable of causing poisoning, but the disease thus produced is of a milder form. TNT poisoning increases in hot and humid weather, but TNT dermatitis, although more prevalent in the summer, is not affected by hot weather. Young men are more susceptible to the affection than older men, and it was found that negroes are not susceptible to TNT dermatitis. Utilising Webster's urine test, it was observed that TNT is eliminated almost as rapidly as it is absorbed. The value of occasional leave and the danger of working overtime therefore become evident. Webster's urine test is useless for the diagnosis of the disease, but the colour changes in the untreated urine and the blood changes of the patient are worthy of further study and might lead to improved diagnosis.—(*J. Ind. Hyg., July*, 1921.)

Wool-degreasing by Means of Solvents.—The process of wool-scouring as usually carried out in this country on an enormous scale consists briefly in the removal of grease and dirt by treating the wool in a warm dilute alkaline soap solution; and although the degreasing of wool by means of solvents has long been known and practised on a large scale, particularly in America, the method has not been adopted to any extent in this country. The reason for this is probably to be sought for in the very strong prejudice created some years ago by a disastrous accident which occurred in connexion with a solvent extraction process in Bradford. In a recent article in the *Yorkshire Post*, Mr. John I. Craven describes briefly the solvent extraction process as carried out by the Arlington Mills Company, of Lawrence, Mass., U.S.A., where solvent extraction has been in use for over 28 years. The wool is lightly packed in kiers holding at least 1000 lb. and naphtha is run in for about twenty minutes, or until the grease content of the wool is reduced to the required degree. Throughout the process the solvent does not come into contact with air, but is circulated through and removed from the plant by compressed carbon dioxide, so that the risk of fire or explosion is reduced to a minimum. After the removal of the grease, the wool still contains its natural potash salts, which suffice to remove the dirt and complete the cleansing process when the wool is treated with warm water in wool-washing machines of the usual type.

Plant for continuous extraction is also employed in some mills. In this the wool is passed through the solvent on an apron. Such plant saves time and labour, but the risk of fire or explosion is probably greater than in extraction in kiers.

Among the advantages in favour of the extraction process over the soap-scouring process are the following:—(1) Increase in the weight of cleaned wool obtained; (2) reduction of noilage in combing due to the staple not being broken or matted; (3) saving of soap and alkali; (4) production of neutral wool fat; (5) superior working qualities of tops and yarn and obvious improvement in strength and softness of the goods produced.

The adoption of solvent grease extraction in Bradford would obviate the expense of wool-grease recovery at the Esholt works and produce a wool-fat of higher value than the wool-grease recovered by the acid process usually employed. It is certainly hard to understand why progressive Bradford wool-scourers have failed to adopt a process which appears to offer obvious advantages, especially when solvent extraction of oil from oil-seeds and other materials has been carried out in this country on a very large scale for years past without any serious accidents.

A New Glass Factory in Rio de Janeiro.—In Rio de Janeiro there has been erected a large modern glass factory which will utilise native raw materials and will have an initial daily capacity of 60,000 bottles and 20,000 pieces for use in chemical work. —(*U.S. Com. Rep., June* 20, 1921.)

Lignite Research in Germany.—The foundation stone was recently laid of the new Lignite Research Institute in Freiberg, Saxony, for which the sum of 10·5 million marks (about £36,200 at the current rate of exchange) has been raised by the State of Saxony, the lignite-mining industry, and the town of Freiberg. The Institute will comprise a chemical, a calorimetric, and a mechanical department.—(*Chem.-Z., Aug.* 11, 1921.)

Census of Chemists and Chemical Students in Germany.—A census of chemists employed in industry which was taken on January 1 last gave the following results (the figures in parenthesis refer to the previous year):—Chemists 2571, of whom 38 (16) were females (2296 in 1920, and 2686 in 1913); chemical technologists 727 (582); chemists, who were proprietors, directors, etc., 481 (456); chemical technologists, male, 4 (5), female, 2. These figures apply to 501 different firms, but there were 75 (66) chemical undertakings which employed no chemists.

The total number of chemical students at the Universities and technical institutes was 6787 during the winter semester of 1920–21, as compared with 6033 in the summer semester of 1920, 4649 in that of 1919, and 2729 in the winter semester of 1913–14. It is estimated that in two years' time at least 3000 chemical students will be leaving the Universities, etc., and that one-half of these will be seeking to enter the industry—to a great extent in vain.—(*Z. angew. Chem., May* 10, 1921.)

Recovery of Carbon Dioxide in the Sugar Industry.—As the present high price of power alcohol is stimulating the manufacture of spirit as a by-product of the sugar industry, it is of interest to know that the cost of production can be reduced by utilising the carbon dioxide generated during the fermentation. According to the West India Committee Circular of April 14, 1921, in the manufacture of 100 galls. of 95 per cent. alcohol, there is a production of 760 lb. of carbon dioxide which can be collected and liquefied by appropriate machinery. In view of the present economic importance of the utilisation of industrial by-products, it would seem that a distillery making alcohol from exhausted molasses should make use of the carbon dioxide evolved during fermentation.—(*Ind. Tr. J., June* 10, 1921.)

The Sugar Industry in Czechoslovakia.—Czechoslovakia is the second largest producer of beet sugar in the world, it has about 500,000 acres of beet under cultivation, and it is the only European country that exports sugar to any extent. In 1920–21 the output from 189 factories and refineries was 715,000 t. of sugar, of which 216,000 t. was exported and about 84,000 t. is still available for export. The industry, however, is in a serious position owing to the great increase in costs of production; in fact, it is quite probable that European beet sugar may eventually be unable to compete with cane sugar. White Java sugar was quoted in Vienna recently at 74 kronen per kg. (krone=10d. at par, now about 0·11d.) whereas Czechoslovakian granulated and raw sugar cost 96 and 88 kronen, respectively. Beets that cost 15 kr. per quintal in 1919–20 now cost 30 kr., and materials such as coal, coke, sacks, lubricating oil, and cloth now cost from 2 to 5 times more. Besides heavy increases in salaries, etc., the cost of replacing plant has become exorbitant; thus the price of a battery of 16 diffusion units of 132 galls. has risen from 56,000 kr. in 1915 to 1,031,200 kr. in 1920, and other prices have risen in proportion.—(*Ind. Tr. J., May* 27, *July* 28, 1921.)

REPORTS.

Report on the Industrial and Commercial Situation in Austria, dated May, 1921. *By* O. S. Phillpotts, *Commercial Secretary to H.M. Legation, Vienna. Department of Overseas Trade. Pp.* 56. *London: H.M. Stationery Office.* 1921. *Price* 1s. 6d. *net.*

The Austrian Republic contains approximately one-eighth of the area and population of the former Austro-Hungarian Monarchy, and about 95 per cent. of its inhabitants are German-speaking. Although deprived of the greater portion of its natural resources, Austria still possesses one of the most valuable iron-ore deposits in Europe in the Erzberg, Styria, magnesite in Styria and Carinthia, and salt near Salzburg and in the Tyrol. The production of iron ore has diminished from 2,366,893 tons in 1916 to 428,500 t. in 1920, and owing to lack of coal and coke the output of iron has fallen proportionately. The iron industry is dominated by the Alpine Montan company, in which a German-Swiss syndicate, headed by Hugo Stinnes, holds a large interest. Deprived of the oilfields of Galicia, liquid fuel has to be imported, but it is hoped that the extraction of oil from shale in the Tyrol will be started in 1921. Only 9 per cent. of the available water-power, 2,250,000 h.-p., is utilised, and in the absence of foreign capital further development is impossible.

Owing to the fluctuating exchange, it is not possible to estimate accurately the relative value of the Austrian imports and exports, but it is certain that the trade balance is most unfavourable; in 1919 and 1920 the imports were four times as great as the exports, by weight. In the absence of raw materials for export, the country will have to pay its way by producing and exporting finished products. Imports are mainly derived from Germany and Czechoslovakia, but small quantities of raw rubber, pig iron, chemicals and allied products (378 tons out of a total of 71,349 t.), fats and greases, and mineral oils figured among the imports from Great Britain in 1920. In the same year Austria supplied the United Kingdom with 3268 t. of calcined magnesite, 113·8 t. of glassware and 488 t. of earthenware. It is considered certain that Vienna will continue to be the most important trading centre for south-eastern Europe, and British firms are asked to remember that there are many thoroughly sound commercial and manufacturing houses in Austria which may have been inconvenienced but have not been endangered by the bad financial conditions.

Report on the Economic and Financial Conditions in South Africa, dated June, 1921. *By* W. G. Wickham, *H.M. Senior Trade Commissioner in S. Africa. Department of Overseas Trade. Pp.* 45. *London: H.M. Stationery Office.* 1921. *Price* 1s. 3d. *net.*

The slow industrial development of S. Africa is ascribed mainly to the backward state of engineering, and this in turn to the absence of a local iron and steel industry. The great developments which are projected for the manufacture of iron and steel may well result in an industrial revolution (*cf.* J., 1921, 292 R). Other industries in which developments are probable are fertilisers, cement, coal and oil-shale distillation, maize products, paper, and rubber goods; except for cement, of which the production is inadequate for the country's needs, the output is mostly on a very small scale. Certain manufactures, such as glass, earthenware, and tinplate, are severely handicapped by the high cost of distribution of bulky, low-priced goods, so that competition with oversea products, particularly at the coast, becomes difficult. The wattle-bark extract industry is firmly established and continues to expand; the utilisation of spent bark for paper making is being investigated; it is proposed to submit the stripped wattle-logs to destructive distillation; and three paper mills are being built.

One result of the recent industrial developments is that the potential demands of the South African market have been permanently reduced. Nevertheless the value of the imports increased from £46,712,795 in 1919 to £93,404,962 in 1920, despite the decrease in tonnage. Among the imports were:—Iron and steel, £3,068,589; leather, unmanufactured, £300,061; wax, paraffin and stearin, £813,966; glass and glassware, £918,337; oils, £2,997,741; paints, etc., £592,070; drugs, chemicals, and medicines, £1,523,131; rubber goods, £1,396,944; paper, all kinds, £1,555,517. Great Britain has recovered much of the import trade into South Africa which was taken by the United States and Japan during the war; in 1920 its share was 54 per cent., whereas America's was 18, Japan's 1.8, and Germany's less than 1 per cent. Exports were valued at £77,799,172 (£95,803,661 in 1919) and included:—Bark, wattle and extract, £986,484; hides and skins, £4,233,894; sugar, £434,998; coal (except bunker coal), £1,482,862; diamonds, £11,597,451; gold, crude, £35,547,079; oil, whale, £233,079; soap, £41,746; fertilisers, £73,946. Of the exports, the United Kingdom took 76, Japan 8, and the United States 5 per cent.

In regard to equipment for the new laboratories being erected at Cape Town University and in the Johannesburg School of Mines, manufacturers are advised to sell their goods to such institutions on favourable terms, if not to supply them gratis, as is being done by American and German manufacturers. It is pointed out that there is probably no form of advertisement—to put it on its lowest plane—so remunerative as that of familiarising young chemists and engineers with the names of the makers of laboratory appliances.

Report to the Board of Trade of the Departmental Committee on Carbon Monoxide. *Pp.* 12. *London: H.M. Stationery Office.* 1921. [*Cmd.* 1422.] *Price* 1d.

A Departmental Committee was appointed by the Board of Trade on January 3, 1921, in accordance with the provisions of the Gas Regulation Act, 1920, to inquire into the necessity for or desirability of prescribing any limitation to the proportion of carbon monoxide which may be supplied in gas used for domestic purposes. In a report to the Board of Trade (*cf.* J., 1919, 191 R) the Fuel Research Board recommended, *inter alia*, that gas undertakings should be allowed to deliver to the consumer any mixture of the ordinary combustible gases free from sulphuretted hydrogen and not containing more than 12 per cent. of inert constituents; later, this recommendation, except as regards inert constituents, was embodied in the Gas Regulation Act, 1920. The practice of enriching coal gas with carburetted water gas, originally introduced in order to provide gas of a legally-specified illuminating power, has been extensively applied in recent years as it appears to possess economic advantages. Thus in 1898 the quantity of water gas made was 5½ per cent. of the total gas manufactured, and in 1919, 15·5 per cent. Straight coal gas contains about 7 per cent. of carbon monoxide, blue water gas about 42, and carburetted water gas from 25—30 per cent.

Water-gas manufacture possesses the advantage of low labour and establishment charges; the process permits of the utilisation of surplus coke and the plant necessary for such manufacture can be quickly put into operation. It was contended that a limitation of the permissible percentage of carbon monoxide was desirable owing to the serious risk to life and health arising from small escapes of gas containing an excessive proportion of carbon monoxide. Statistics submitted to the Committee regarding poisoning by gas were deficient in certain respects. Inquiry on this matter made to the United States Public Health Service elicited the reply that in the United States, where many gas undertakings supply gas containing 100 per cent. water gas, the presence of up to 30 per cent. carbon monoxide has been found in no way prejudicial to the public health. The Committee is convinced that economic advantages accompany the use of water gas and reports "that it is not necessary or desirable to prescribe any limitations of the proportion of carbon monoxide which may be supplied in gas used for domestic purposes." The Committee recommends that the attention of Parliament be again directed to the matter should such freedom from limitation be accompanied by unexpectedly unfavourable results, and suggests that it should be made an offence to supply gas for domestic purposes which does not possess the distinctive smell of coal gas.

Report of the Fuel Research Board for the Years 1920, 1921. *First Section: Steaming in Vertical Gas Retorts. Pp. viii.+54. London: H.M. Stationery Office,* 1921. *Price* 1s. 6*d. net.*

In order that the results of experimental work may be readily available to those concerned, the work of the past year is to be published in two or more sections; the report now published is entirely devoted to steaming in vertical gas retorts, a question which became more important after gas undertakings were allowed to select their own standard of calorific value. For this investigation, a setting of four Glover-West continuous vertical retorts was erected at the Fuel Research Station, with modifications for heating the retorts with water gas from an outside source and air supplied under pressure through an exchanger heated by the waste gases. The throughput of coal per day was 10 tons, and a trial usually lasted 5 days. Three different types of coal were used, as it was realised that differences of type are of much greater importance in vertical retorts, particularly when steam is introduced, than in horizontal retorts. The work covers similar ground to that covered by the Gas Investigation Committee of the Institution of Gas Engineers at Uddingston, but particular attention has been paid to the practical rather than the chemical aspect of the problem (*Cf.* J., 1920, 199 R). Careful determinations were made of the extra heat to be supplied to the retorts in order to obtain the higher yields of gas, tar, and ammonia, resulting from the introduction of steam. A fundamental test in this connexion, which should be made at any works where it is hoped to make full use of the results obtained at the Research Station, was the determination of the heat required to maintain the setting at carbonising temperatures with no coal passing through the retorts. The arrangements were such that a very accurate weight balance between coal and steam entering, and the various products leaving, the retorts could be obtained. It is realised that different results may be given by different coals and that in ordinary gas works it is practically impossible to make the necessary measurements with great accuracy, but it should be possible to arrange for information to be obtained at the Research Station for any particular coal.

A special feature of the plant described in the report is an air preheater, constructed of steel tubes superimposed upon the setting, the use of which led to a saving of 8·5 to 10·5 per cent. of the gas supplied for combustion. The heat required to maintain the combustion chambers at the carbonising temperature (1260° C.) was 12·4 therms per hour. This quantity is relatively large owing to the small size of the setting, and in the tabulated results it is subtracted from the expenditure of fuel gas during the actual trials in order to render the results more readily comparable with those obtained in other settings. By this means it has been possible to make comparisons with the results obtained at Uddingston.

Each coal was first carbonised without steam and then with an addition of up to 30 per cent. by weight of the coal, and it is provisionally concluded that about 20 per cent. of steam could be economically employed with all coals suitable for use in vertical retorts. With the addition of this amount of steam a Yorkshire coal, Mitchell Main, gave extra yields per ton as follows:—Gas, 33 therms; tar, 34 lb. and ammonium sulphate, 6 lb., with an extra supply of heat of 10 therms in the forms of fuel and steam. Lanarkshire Main and Ell coal gave the following extra yields:—Gas, 19 therms; tar, 40 lb., and ammonium sulphate, 11 lb. Of the total potential heat of the coal 30 to 33 per cent. was converted into the form of gas with a calorific value of 432—460 B.Th.U. per cb. ft. There is a depreciation in the quantity and quality of coke produced, but owing to the increased turnover per retort, there is an actual saving in labour charges. Without any additional heat being supplied to the combustion chambers, it is possible to carbonise the same quantity of coal using a quantity of steam which varies from 10 to 15 per cent., according to the nature of the coal, and thereby obtain increased yields of gas, tar, and ammonia. If it is desired to use more steam, consideration must be given to the ability of the producers to supply extra gas, the thermal conductivity of the retort walls, and the tendency of the coal charge to stick in the retort. The upper limits to which steaming can be carried economically will depend upon local economic factors as well as upon purely technical considerations, so that each individual case must be dealt with on its merits.

GOVERNMENT ORDERS AND NOTICES.

Prohibited Exports.—The Board of Trade (Licensing Section) announces that nicotine and its compounds will be removed from the list of prohibited exports as from September 1.

An open general licence has been issued permitting, as from September 8, the export of sulphate of ammonia, and of compound manures having sulphate of ammonia as the only export-prohibited constituent.

Explosives in Coal Mines Order.—The Secretary for Mines has made an order entitled "The Explosives in Coal Mines Order of August 24, 1921," which extends to December 31, 1923, the period during which the non-detonating explosives named and defined in the Second Schedule to the Explosives in Coal Mines Order of September 1, 1918, are included in the term "permitted explosives."

Manufacture and Storage of Celluloid.—A notice has been issued by the Home Secretary stating that he proposes to make regulations dealing with places in which celluloid, or any article wholly or partly made of celluloid, is manufactured, manipulated, or stored. The draft regulations, objections to which may be submitted before September 20, deal with the storage of celluloid, the limitation of the amount present in a workroom, means for extinguishing fire, etc.

Committee on Lead Paints.—A Committee has been appointed by the Home Secretary to re-examine the question of the danger of the use of lead paints to workers in the painting trades, the comparative cost and efficiency of paints containing lead and leadless paints respectively, and the effect of such paints on the health of the workers; and to advise on the need for any modifications of the conclusions and recommendations of the Departmental Committees appointed to consider the question in 1911. The Committee consists of Sir H. Norman (chairman), Mr. G. Bellhouse, Mr. O. J. Kauffmann, M.D., Mr. T. M. Legge, M.D., Mr. A. Munby, Mr. A. Scott, D.Sc., and Mr. H. O. Weller. The Secretary is Mr. C. W. Price, the Home Office, Whitehall, S.W. 1.

OFFICIAL TRADE INTELLIGENCE.

(From the Board of Trade Journal for August 25, *September* 1 *and* 8.)

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W. 1, from firms, agents, or individuals who desire to represent U.K. manufacturers or exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department and quoting the specific reference number.

Locality of firm or agent.	Materials.	Reference number.
Australia	Glassware	*412/20/7/729
,, ...	Earthenware	183
British West Indies	Oils and greases	200
Canada	Soap, polish	174
,, ...	Paper	†
,, ...	Superphosphate	‡
,, ...	Industrial chemicals	196
South Africa ..	Wire	175
,, ...	Paper	186
,, ...	Paints, oils, colours	199
New Zealand ..	Copper cable	176
Italy	Chinaware, glassware	189
Rumania	Black and galvanised sheets, tinplate, tallow, fatty acids, sulphuric acid, copper sulphate, ammonia, caustic soda, chemicals, drugs, colours, paint, varnish, palm oil, linseed oil, soap, perfumery. [Goods in demand]	
United States ..	Chinaware	215
Argentina ..	Iron, steel	191
Brazil	Tinplate, wire, arsenic, caustic soda, rosin, chemicals, earthenware	192

* The Official Secretary, Commercial Information Bureau, Australia House, Strand, W.C. 2.

† The Canadian Government Trade Commissioner, 73, Basinghall Street, London, E.C. 2.

‡ The High Commissioner for Canada, 19, Victoria Street, London, S.W. 1.

Market Sought.—A Brazilian company able to export hides, leather, lard and beeswax desires to get into touch with U.K. importers. [192.]

TARIFF. CUSTOMS. EXCISE.

British Honduras.—The import of opium in any quantity of less than 5 lb. is prohibited except with the previous consent of the Governor in Council; further, opium must not be imported in packages containing goods of any other description.

Bulgaria.—The General Tariff of 1904, as modified by the laws of 1911 and 1912, and Article 10 of the Budget Law of 1919-1920, are applicable to imports of any origin, except salt. These rates are double of those in force at the outbreak of the war.

Canada.—The import of oleomargarine is permitted until August 31, 1922.

Esthonia.—Export duties have been levied on milk powder, broken glass, certain raw skins, and crystallised washing soda.

The customs duties on gums, resins, and volatile oils have been modified.

The export and transit of gold, silver and platinum and alloys, and manufactures thereof, are prohibited, except under special licence.

Fiji.—Condensed milk containing less than 8 per cent. of butter fat, and milk powder may not be imported unless marked "unfit for infants."

France.—The "coefficients of increase" have been modified on kieselguhr, liquid chlorine, hydrochloric acid, liquid sulphur dioxide, sulphate of alumina, potash and ammonia alums, barium peroxide, sodium and potassium chromates and dichromates, magnesium chloride, magnesium sulphate, anhydrous sodium sulphate with less than 25 per cent. of salt, and rectified methyl alcohol.

Germany.—It is proposed to increase the customs duties on cocoa and chocolate and the consumption duties on sugar and matches.

Hungary.—The export duty on sugar has been abolished, and that on vegetable fatty oils is fixed at 50 kr. per kg.

The customs duties are still suspended on, *inter alia*, molasses, lard, fish oil, tallow, palm oil, palm kernel oil, coconut oil, pyrites, mineral oils, lignite and schist tars, scrap iron, iron alloys, and lead and zinc scrap and waste.

Italy.—Export licences are no longer required for copra, fish oils, mineral oils (except petrol and petroleum), oilseeds, nut oil, olein, white metal scrap, and mixed turnings of white metal and bronze.

Newsprint dyed in the pulp is now admitted duty free until December 31.

Latvia.—The Government linseed monopoly has been abolished.

As from August 9 all restrictions on the sale, purchase and transport of tanned and untanned hides have been rescinded.

Particulars of the rates of duty under the new customs tariff may be obtained on application to the Department. All import prohibitions have been withdrawn.

Luxemburg.—The new customs tariff provides for the application of "coefficients of increase" (not to exceed 6 in any case) to the specific duties. Information as to the rates on the various classes of goods may be obtained on application to the Department.

Martinique.—The customs duties leviable on imported chemical matches and chemical products for matches have been modified.

Mesopotamia.—The *ad valorem* rate of customs duty has been increased to 15 per cent. on all dutiable articles except dyes, gums, resins, hides, skins, fertilisers, pitch, tar, dammar, soda, tallow, stearin, tanning materials, wax, salt, sugar, etc.

Nigeria.—Increased import duties are payable on kerosene, matches, soap, perfumed or medicated spirits, etc. as from August 24.

Portugal.—Export surtaxes have been abolished on carbon disulphide and Portuguese cocoa and chocolate.

Essential oils not specified and synthetic products for perfumery pay duty at the rate of 75 cents per kg. In addition there is levied a surtax of 1 escudo per kg.

Sierra Leone.—The general *ad valorem* duty on imports has been raised to 25 per cent., and the rates for sugar and petrol have been modified.

Tunis.—Export restrictions have been removed from glucose, extracted fats, and natural phosphates of lime.

United States.—The dye import control is continued until November 27.

TRADE NOTES.

BRITISH.

The Gold Coast in 1919.—The great revival of trade in this Colony during 1919 was largely due to the removal of the ban on the exportation of cocoa; the shipment of 176,000 tons of cocoa worth £8,278,000, *i.e.*, an amount equivalent to more than half the world's supply, was a record for the Gold Coast. Quantity rather than quality production is now the rule, but some attempts are being made to improve cultivation and to control disease. Exports of palm products increased substantially. The oil palm is not cultivated on a large scale by the natives, and nothing like the maximum production is obtained from wild plants. Rubber has sunk to the position of a minor export, owing to the decline in the collection of wild rubber due to the revival of the cocoa trade. The exports, which increased by 142 per cent. to £10,814,175, included:—Cocoa, 176,000 t.; palm kernels, 9986 t.; palm oil, 938,595 galls.; copra, 984 t.; kola nuts, 7286 t., rubber, 253 t.; gold, 359,846 oz.; manganese ore, 33,192 t. The manganese industry is held to offer considerable promise. Diamonds were discovered in the shallow, gold-bearing gravels of the Abome River, in Eastern Akim, and in Kyebi. The bauxite deposits on Mount Ejuanama, Kwahu, were examined and the ore found to be of good general quality; the total reserve is estimated at 3 million tons, but may be considerably more. Prospecting was continued on the tin deposits situated near Mankwadi (Central Province), but no tin ore was exported. Of the imports, valued at £6,895.969 (an increase of 152 per cent.), the United Kingdom supplied 74 and the United States 21 per cent., compared with 73 and 21 per cent., respectively, in 1918.—(*Col. Rep.-Ann., No.* 1066, 1921.)

FOREIGN.

Brazilian Trade in Vegetable Oils and Oil-bearing Materials.—The appended table gives statistics of of the exports of vegetable oil and oil-bearing materials from Brazil in 1919:—

	Long tons
Cottonseed oil	2,196
Coconut oil	149
Castor oil	1,368
Groundnuts	201
Castor beans	23,401
Ucuhuba seeds	1,001
Cottonseed	22,291
Copra	20
Palm nuts	10,861
Oilseeds, other	564

The imports were relatively small and comprised:—Linseed oil, 2559 t.; cottonseed oil, 36t.; palm oil, 94 t.; olive oil, edible, 1369 t.; vegetable oils, other, 223 t.—(*U.S. Com Rep., Apr.* 21, 1921.)

The Philippines in 1920.—The chief crops grown in the Philippines are rice, maize, hemp, coconut, coffee, cacao, maguey and sisal. In the year ended June 30, 1920, the area planted to sugar was 487,585 acres, and the total crop amounted to 423,580 metric tons of crude sugar and 901,115 galls. molasses; the sugar crop for 1921 is estimated to be 15—20 per cent. larger than that of 1920. Coconuts were grown over 980,664 acres, and the production was 361,605 t. copra and 523,479 galls. coconut oil; the bulk of the copra was manufactured locally. The chief export crop is Manila hemp ("abaca"), which requires little cultivation; the yield was 165,081 t., but it is estimated that the 1921 crop will be only 50 per cent. of the normal production. An attempt is being made to increase the yield of maguey and sisal fibre by introducing stripping machines; the export of these two fibres was 18,178 t.—(*U.S. Com. Rep., July* 18, 21, 1921.)

Algerian Trade in 1920.—The foreign trade of Algeria developed well in 1920, and the constant growth of the amount of goods in transit demonstrates the importance of the country as a distributing centre for North Africa. Imports rose from $262,005,799 to $489,287,424, but exports declined from $326,135,646 to $278,224,361, owing to bad crops, export prohibitions, and uncertain economic conditions. The chief imports and exports of chemical and allied products are given below:—

Imports :—		Metric tons.	
		1920.	1919.
Cement		35,015	19,772
Candles, soaps		12,132	10,817
Acids, hydrochloric, sulphuric, tartaric		512	253
Calcium carbide		3,452	1,659
Salt, sea and rock		8,288	9,990
Copper sulphate		6,291	2,939
Superphosphates		249	1
Chemicals, various		19,191	5,902
Colours, ink, varnish, etc.		2,374	955
Dyes, prepared		73	20
Fats, oleomargarine, etc.		1,298	386
Fertilisers		3,027	551
Copper		608	368
Lead		1,001	996
Tin		119	69
Zinc		711	257
Oil, heavy		6,522	1,934
Oil, mineral	hectolitres	317,774	247,918
Oils, vegetable		6,112	4,791
Paper and manufactures of		13,184	7,047
Perfumes		1,608	394
Pottery, earthenware, etc.		11,059	5,181
Glass, glassware		8,876	4,075
Rubber and manufactures of		1,761	610
Sugar, raw and refined		31,111	38,423
Sulphur		28,019	14,287
Exports :—			
Alfa		53,982	5,887
Tartar, crude		1,731	1,504
Salt, sea and rock		1,524	1,699
Superphosphates		11,603	14,576
Cork, all kinds		31,378	17,368
Fibre, vegetable		28,996	18,386
Hides and skins		4,116	3,463
Oil, olive		780	364
Antimony ore		2,966	2,160
Copper ore		601	1,000
Iron ore		1,114,438	782,805
Lead ore		12,801	8,318
Zinc ore		27,716	4,261
Phosphates		334,704	242,186
Tan bark		2,917	2,003
Coal		6,489	5,430

France took about 77 per cent. of the exports in 1920 and supplied about 78 per cent. of the imports. (*U.S. Com. Rep., June* 30, 1921.)

Foreign Company News.—*Germany.*—A new company, the Chemische und Pharmazeutische Werke Mayer Alapin A.-G., with a capital of 1.2 million mk., has been founded at Frankfurt a.M.

The A.-G. Farbwerk Mühlheim vorm. A. Leonhardt and Co., Mühlheim a.M., which is controlled by Leopold Casella and Co., is paying a dividend of 15 (6) per cent. on the original stock and 5 per cent. on the preference shares; the net profit was 575,454 mk. (294,997), 55,000 mk. was carried to reserves, 47,400 mk. (54,760) written off, and the carry-forward was 177,455 mk. (22,462).—(*Chem. Ind., June* 6, 1921.)

United States.—The common stock of the Monsanto Chemical Works has been increased from $700,000 to $3,500,000, which, with $4,000,000 of preferred stock, raises the total capitalisation to $7,500,000.—(*Oil, Paint and Drug Rep., May* 23, 1921.)

France.—A syndicate has been formed by the French manufacturers of celluloid, the most important of which are:—Société Générale pour la Fabrication des Matières Plastiques, Paris, factory at Stains; Société Industrielle de Celluloid, Paris, factories at Villetaneuse, Chouffry, and Oyonnax; Société Lyonnaise de Celluloid, Lyons, factories at St. Fons and Oyonnax; Société L'Oynnithe, Paris, factory at Oyonnax. Various processes are used and different qualities of goods are made by the syndicated firms, but their prices are all the same.

Hungary.—The Donalf Chemische Fabrik A.-G. has been founded at Neupest (near Budapest) with a capital of 1 million kronen (kr. = 10d. at par, now about 0·17d.).

Soviet Russia.—It is reported from Stockholm that the Soviet Government has offered the Swedish Zündholz A.-G. a monopoly of all the match factories in Russia for a limited period and on certain conditions. Should satisfactory security be given, it is stated that the Swedish company will invest a large sum in the industry in order to take over the factories and increase their productive capacity.—(*Chem. Ind., June* 20, *July* 25, 1921.)

REVIEWS.

Estate Rubber, Its Preparation, Properties and Testing. *By* Dr. O. de Vries. *Pp.* 649. (*Batavia: Drukkerijen Ruygrok & Co.*, 1920.) *Price* 20 *fl.*

Commencing with a description of the chemical and physical properties of latex, this book comprises a detailed account of the preparation of plantation rubber and the methods employed at the Institute, Buitenzorg, Java, for testing rubber that have appeared in the *Archief voor de Rubbercultuur.* Frequent short references in the text are made to current literature, but the book may be regarded mainly as an account of the researches carried out by the author or under his direction. The book is rigidly confined to the study of plantation rubber, and the subject matter is therefore more restricted than in the excellent work of Prof. Whitby, recently reviewed in these columns. On the other hand, with the space at his disposal, Dr. de Vries has been able to treat the subject of plantation rubber with more detail, and there is no aspect, even of minor importance, which has not been treated fully.

After the introductory chapter and some account of the latex constituents, the author discusses the composition of the latex and various factors which influence the properties of rubber. He then describes the process of coagulation and the effect produced by different coagulants, anti-coagulants, antiseptics, and other reagents. As is well known, acetic acid is almost invariably employed for the coagulation of *Hevea* latex, but many other methods have been tried from time to time, *e.g.*, heat, cold, evaporation, and even mechanical means. The methods and details of procedure in coagulation affect the properties of the rubber produced, and these points are illustrated by the results obtained by vulcanisation tests carried out at the Institute. Latex, after coagulation, may be made up into rubber in various forms. Of these, two are of outstanding importance and form the bulk of plantation rubber. Latex coagulum much resembles a stiff junket, and may be put through differentially-geared rollers and worked into a rough sheet with an uneven surface which, after air drying, is marketed as crêpe rubber; or the original latex may be coagulated in rectangular pans, and then put through even-speed rollers which convert the rubber into oblong flat sheets. These sheets are then hung in the upper part of a smoke-house, where they are dried. Tho properties of crêpe rubber differ somewhat from sheet rubber and in both cases they are influenced by details in the methods of preparation. All these points are considered by the author and illustrated with a wealth of experimental data. There are also chapters on the keeping-qualities of the rubber, the forms of deterioration rubber may undergo, and a consideration of the various defects of the finished product. Most of these defects are merely matters of appearance and do not influence the vulcanising properties of the rubber; but as rubber is sold entirely on appearance or brand, and not on actual quality, these small defects or faults in preparation are of considerable importance. Keen buyers may force down the price of the rubber by 10 or 20 per cent. merely on surface appearance. Further chapters in the book deal with the lower or scrap grades of rubber, a comparison of the plantation with the Brazilian method of preparation, and some special modes of coagulation and preparation that have been experimented with on an appreciable scale, but which have not yet come into use in the preparation of rubber for the open market. Of these special products, attention is directed to the so-called slab rubber. The method of preparation is similar to that of sheet, but the sheet is made much thicker, and with only very slight rolling. This results in the retention of a large proportion of the serum. The rubber is allowed to dry, but, being in thick slab form, the interior remains moist and opaque. At the same time putrefaction sets in and the surface becomes dark, slimy and malodorous. These changes do not, however, appear to detract from the physical qualities of the rubber, whilst its vulcanisation is much accelerated by the presence of the purefaction bases produced. These points are fully brought out in the text.

The succeeding chapters deal with the technique of vulcanisation, the methods employed at the Institute at Buitenzorg, and the interpretation of the figures obtained. No doubt the author had his reasons for reserving this part of the subject for treatment in the latter part of the book. It would, however, seem to be more logical to discuss the actual testing and interpretation of the figures before comparing the results obtained on vulcanisation of rubber resulting from different methods of preparation. There was a time when vulcanisation as a method of testing was regarded as unnecessarily elaborate. Ten or fifteen years years ago attempts were still being made to find some simple property of the raw rubber that would give an indication of its properties after vulcanisation. Of these, perhaps, the viscosity of the raw rubber sol received the greatest amount of attention, and evidently Dr. de Vries still thinks that viscosity determinations have some practical value. It seems reasonable to suppose that the viscosity of the sol should have some relationship to the properties of the rubber. On the other hand, there is little if any correlation between the physical properties of rubber before and after vulcanisation, and the viscosity is so subject to the pre-treatment of the raw rubber that it is altogether too sensitive a property to be of much use for practical purposes. For vulcanisation work the author uses a standard mixing of rubber with 7½ per cent. of sulphur, and also records the results of tests in which the proportion of sulphur is varied. This and similar work, including the effect of time and temperature variation during vulcanisation, is of great interest. The results are clearly set out. One only regrets that the author has not been able to carry his researches further and to include a wider range of ingredients. If one may venture a criticism, it is that the whole structure of these tests rests on too narrow a basis, and that specimens of rubber classified in accordance with the author's standard tests might not be found to vary in the same manner in the factory, *i.e.*, the standard tests would only serve as a very rough guide to the manufacturer. They would exclude occasional samples as unsuitable but would fail to distinguish between the great bulk of them. Some interesting diagrams on pages 467, 471, and 473 give the results of standard tests on a large number of commercial samples of plantation rubber, but one cannot help being struck with the uniformity in physical properties, particularly in the figures for maximal breaking strain. It is obvious that part of the variation must be ascribed to experimental errors. It is apparent that only rarely does one meet with a sample of sheet or crêpe rubber giving a maximal breaking strain outside the limits of 1·30 to 1·50 kg. per sq. cm., and the figures for maximal elongation are so constant that the author has omitted them entirely. The maximal breaking strain is taken as the main indication of quality. It is clear, therefore, that considerable experimental accuracy is required to distinguish between the great majority of such samples, and further research is needed to ascertain in what other ways plantation rubber varies in physical properties, so as to evolve tests which will more readily distinguish between different specimens. The complaints of manufacturers concerning want of uniformity appear to indicate that considerable differences do exist, and that it is not a case of an occasional weak or deficient sample, as the standard tests would seem to imply.

The concluding chapters deal with the chemical composition of raw rubber. The book is so replete with detail and information that it is not an easy one to read from cover to cover. On the other hand, for reference purposes it is of the greatest value. It certainly gives the fullest, most authoritative and up-to-date account of research work which has been carried out on plantation rubber in the tropics.

Henry P. Stevens.

Cocoa and Chocolate, Their Chemistry and Manufacture. *By* R. Whymper. *Second edition, revised and enlarged. Pp.* 568. *(London: J. and A. Churchill.* 1921.) *Price 42s. net.*

The second edition of this comprehensive work, larger by 230 pages than its predecessor, is divided into three parts. In the first the history of what is now a great industry is traced from the introduction of cocoa into Europe in 1520 until the present day, and interesting details are given as to cost, preparation, and consumption in various countries and times. Succeeding chapters discuss the botany and agriculture of the plant and the preparation of the beans for the market. Elaborate tables of analysis are quoted which throw considerable light on the changes produced by the process of fermentation, but without wishing to suggest any doubts as to their value, it may be said that they would have inspired more confidence had the figures not been carried to three places of decimals. As in addition to this the sum of some 27 determinations, including those of "indeterminate nitrogenous matters," "astringent matters," "pectin, etc.," "cocoa red," and "digestible fibre" is 100·000 in one case and 99·995 in another many readers will feel a pardonable curiosity as to the methods by which such remarkable results were obtained.

Part II. deals with manufacturing processes, and is excellently illustrated with photographs of the principal types of machinery. With regard to dehusking, it is satisfactory to read the author's opinion that with suitable and efficient plant 95 per cent. of the shell can be removed.

Part III. treats of the chemistry of cocoa, and contains an excellent *resumé* of our knowledge of the subject, including a large collection of analyses of shell and nib. Recent work has shown that many of the earlier results are inaccurate, and some indication of the methods employed would have explained a few apparently anomalous or conflicting figures.

The section dealing with processes of analysis is very full and up to date and most clearly written, but here again some critical reference to the merits of alternative processes would not have been out of place.

The determination of the shell is discussed at length, most of the methods hitherto used or suggested being described, and the author rightly emphasises the increased difficulty of the problem now that cocoa is so finely ground.

For the chapter on the microscopical examination of cocoa the author has made a special and careful study of beans fresh from the pod, but from the practical point of view the employment of beans as they occur in the market would have been of more use, and might possibly have modified the statement that "pure cacao powder will show," *inter alia*, "a certain quantity of isolated spirals." Although with the present method of grinding they are usually broken up almost beyond recognition, the presence of spiral vessels in the powder is widely accepted as diagnostic of shell. If they are really found in appreciable quantity in shell-free nib the matter is of some importance. A possible explanation is that the author used *germinated* beans, as it is probable that in ungerminated beans the vessels would only exist in the form of procambium.

A somewhat serious omission in this chapter is the absence of any mention of the mucilage which, being abundant in the shell but absent from the nib, serves as one of the most certain methods of detecting the husk in the commercial powder.

Furnished with an excellent bibliography, a full index and clear and appropriate illustrations, the book is most clearly and interestingly written, and is at the present time the most comprehensive and up-to-date work on the subject in our language.

Cecil H. Cribb.

A Text-book of Assaying. *By* C. *and* J. J. Beringer. *Revised by* H. R. Beringer. *Fifteenth edition, revised. Pp.* xvi. + 471. *(London: C. Griffin and Co., Ltd.,* 1921.) *Price* 12*s.* 6*d. net.*

Students and practitioners of assaying during the last thirty years owe a great debt to the late J. J. Beringer for his comprehensive survey of the subject. The appearance of the fifteenth edition of his book proves that it has met an urgent demand, and that it still holds a prominent place in the long list of English and foreign books which have been published on the subject.

In his original preface Mr. Beringer states that ". . . . the word 'assaying' is difficult to define . . . . and the distinction between 'assayers' and 'analysts' will in time be difficult to detect." The intervening years have borne out this prophecy, and to-day, except in the case of dry assay work, the two sets of workers use practically identical methods. The advances have been rapid owing to the concentration of many minds on a limited field. From this arises the first criticism which may be made of the later editions of this book. Some processes which have passed into common use are either barely mentioned or not mentioned at all. Typical of such omissions are:—(1) Modern assaying balances, which have attained a high degree of accuracy, especially for bullion work. (2) The Eschka method for the determination of mercury. (3) The potassium-bromate and potassium-permanganate methods for the volumetric determination of antimony. It is recognised that there is a limit to the amount of matter which can be satisfactorily included in a book of this nature; but it would probably be wise, in a future edition, to make a bold step forward and include a number of the more recent well-tried methods.

The excellent plan of inserting experimental figures to show the working of most of the processes and the influence of impurities on them is retained. Indeed, the principles of assaying are in the main carefully set out, a feature which has always been appreciated, and has helped materially to keep the book in the forefront.

A disappointing feature of the new edition is the increasing number of appendices. Some of these were introduced in the early editions, and might very well have been incorporated in the general text ere this. Unless some particular item is of extreme importance, or a suitable context cannot be found, it would better serve its purpose in proximity to discussion of an allied nature.

Roasting of material for dry assay in dishes is now more generally preferred to roasting in crucibles, as the material is easier of access and exposes a larger area to the oxidising atmosphere; but when nitre and other desulphurisers have to be used, crucibles must necessarily be employed, although in this case the addition would be made, after trial, to the ordinary charge by fluxes.

Vanning, we are told, is still mainly the method of assaying ores in tin mines, principally because it gives a result in black tin which approximates to the probable recovery on the dressing floor. This method is recognised as inaccurate, and Beringer (Appendix D) said many years ago that we should see a steadily increasing application of wet methods. Apparently the author was not such a good prophet in this case. Confusion and inaccuracy still arise owing to the varied terms in which tin recovery is expressed, and conditions will not alter until a standard accurate method is adopted generally. Recoveries could always be returned in percentages, and the efficiencies in various mines would then be more comparable than they are at present.

That the book will continue to be useful is certain, but in some details there is a tendency not to keep abreast of modern work and requirements. This is to be regretted, and one hopes that future editions will be improved in this respect. It may mean drastic elimination to make room for new matter; it may even mean entire remodelling. The foundation, however, is good and well conceived, and it deserves to have built upon it a structure which would always be worthy of the ideals which the late author had in mind.

W. A. C. NEWMAN.

METALLIC ALLOYS: THEIR STRUCTURE AND CONSTITUTION. *By* G. H. GULLIVER. *Fourth Edition. Pp.* 439. *(London: C. Griffin and Co., Ltd.,* 1921.) *Price* 15*s. net.*

The fourth edition of this well-known text-book is identical with the third, except for the addition of an appendix dealing with the rate of cooling on the constitution of binary alloys. This is taken from a series of papers which the author contributed to the Journal of the Institute of Metals, and includes a consideration of the proportions of solid and liquid at any stage in the freezing of a quickly cooled alloy, and with the alteration in the apparent form of the solidus curve with increased rates of cooling.

The general features of the book are familiar. It covers a very wide range of subjects, and is full of information which is useful to the student of metallography. The treatment of alloy steels is not very satisfactory, the constitution being expressed by means of Guillet's diagrams, which have very little value at the present day. The account of the iron-nickel series overlooks the fact that the true constitution of these peculiar alloys was determined by Benedicks in 1911. The statement on page 230 that vibration assists in the annealing process is surprising. The author mentions unpublished experiments of his own on this point, and it is to be hoped that these will be made public, as the effect suggested is not at all one that would be expected. The crystallisation of metals under alternating stress, commonly believed in by engineers, is a myth. The photomicrographs, mostly taken from well-known sources, have unfortunately suffered greatly in reproduction, a few of them, such as figures 164 and 194, scarcely showing any recognisable structure. This is possibly due to the character of the paper used in the production of the book.

CECIL H. DESCH.

PUBLICATIONS RECEIVED.

EARLY SCIENCE IN OXFORD. PART I. CHEMISTRY. *By* R. T. GUNTHER. *Pp.* 91. *(London: Humphrey Milford. Oxford University Press.* 1921.) *Price* 10*s.* 6*d.*

TECHNICAL RECORDS OF EXPLOSIVES SUPPLY. 1915—1918. No. 2. MANUFACTURE OF TRINITROTOLUENE (TNT) AND ITS INTERMEDIATE PRODUCTS. *Pp.* 116. *Ministry of Munitions and Department of Scientific and Industrial Research. (London: H.M. Stationery Office.* 1920.) *Price* 17*s.* 6*d.*

REPORT OF THE FOOD INVESTIGATION BOARD FOR 1920. *Department of Scientific and Industrial Research. Pp.* 39. *(London: H.M. Stationery Office.* 1921.) *Price* 1*s.*

THE MINERAL INDUSTRY OF THE BRITISH EMPIRE AND FOREIGN COUNTRIES. STATISTICAL SUMMARY (PRODUCTION, IMPORTS AND EXPORTS), 1913—1920. *Imperial Mineral Resources Bureau. Pp.* 104. *(London: H.M. Stationery Office.* 1921.) *Price* 3*s.*

CHEMICAL DISINFECTION AND STERILIZATION. *By* S. RIDEAL *and* E. K. RIDEAL. *Pp.* 313. *(London: Edward Arnold and Co.* 1921.) *Price* 21*s.*

MINING PHYSICS AND CHEMISTRY. *By* J. W. WHITAKER, *with an Introduction by* PROF. W. H. MCMILLAN. *Pp.* 268. *(London: Edward Arnold and Co.* 1921.) *Price* 9*s.*

KOLLOIDCHEMIE UND PHOTOGRAPHIE. *By* DR. LÜPPO-CRAMER. *Second edition, revised. Pp.* 112. *(Dresden and Leipzig: Theodor Steinkopff.* 1921.) *Price* 7*s.* 10*d.*

PUBLICATIONS OF THE UNITED STATES GEOLOGICAL SURVEY. DEPARTMENT OF THE INTERIOR. *(Washington: Government Printing Office.* 1921):—

- GOLD, SILVER, COPPER, LEAD, AND ZINC IN UTAH IN 1919. *By* V. C. HEIKES.
- GOLD, SILVER, COPPER, LEAD, AND ZINC IN NEVADA IN 1919. *By* V. C. HEIKES.
- GOLD, SILVER, COPPER, LEAD, AND ZINC IN MONTANA IN 1919. *By* C. N. GERRY.
- GOLD, SILVER, COPPER, LEAD, AND ZINC IN IDAHO AND WASHINGTON IN 1919. *By* C. N. GERRY.
- GOLD, SILVER, COPPER, LEAD, AND ZINC IN THE EASTERN STATES IN 1920. *By* J. P. DUNLOP.
- GOLD, SILVER, COPPER, LEAD, AND ZINC IN ARIZONA IN 1919. *By* V. C. HEIKES.
- BARYTES AND BARIUM PRODUCTS IN 1919. *By* G. W. STOSE.
- CONCRETE STONE AND CONCRETE BLOCKS IN 1919. *By* G. F. LOUGHLIN *and* M. E. MCCASLIN.
- MAGNESITE IN 1920. *By* C. G. YALE *and* R. W. STONE.
- MAGNESIUM IN 1920. *By* R. W. STONE.
- CHROMITE IN 1920. *By* E. SAMPSON.

TRAINING FOR FOREIGN EXPLORATION. *By* H. F. BAIN. *School of Mines and Metallurgy, University of Missouri. Bulletin, June,* 1921. *Pp.* 19. *(Rolla, Missouri.* 1921.)

PROCEEDINGS OF THE ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA. *Vol.* 37. *No.* 2. *March,* 1921. *(Pittsburgh: Union Arcade Building.* 1921.)

THE ANNUAL MEETING AT MONTREAL.

The fortieth annual meeting of the Society, and the first that has ever been held in Canada, has been a marked success; it will be long remembered by those who were privileged to attend it. Over 225 members of the Society took part in the meeting, those from overseas having spent more than a week sight-seeing in the Province of Quebec and in Montreal before the proceedings commenced. Very great credit is due to the committee, under the able chairmanship of Mr. H. W. Matheson, of the Canadian Electro-Products Co., for the excellent arrangements made for entertaining the guests. In addition to the British visitors, several prominent American chemists were present, including Dr. Edgar F. Smith, president of the American Chemical Society, Dr. C. H. Herty, editor of the *Journal of Industrial and Engineering Chemistry*, and Dr. W. H. Nichols, president of the Allied Dye and Chemical Corporation. The proceedings furnished ample evidence of the vitality of Canadian chemical industry and of the resourcefulness of Canadian chemists, and the visits to numerous works proved to be both enjoyable and instructive. Favoured by ideal weather conditions, the various excursions, visits and receptions were most successful, and the generous hospitality so freely offered was highly appreciated by the visitors.

The proceedings of the annual general meeting, held in the McDonald Chemistry Building, McGill University, are recorded elsewhere in this issue (pp. 403—408 T). In the afternoon of August 29 a civic reception and lunch, presided over by Dr. Milton Hersey, were given at the Ritz-Carlton Hotel, and the Pro-Mayor, Alderman Dubeau, welcoming the Society on behalf of the City of Montreal, expressed the hope that the hearty co-operation between English and French which had proved so valuable during the war would be continued in times of peace. Later in the afternoon the authorities of the McDonald College gave a garden party and tea at which Prof. J. F. Snell, professor of chemistry, was host; exhibits which were placed in the college grounds attracted much attention. A meeting of representatives of the Local Section was held in the evening under the chairmanship of Mr. Wardleworth, and suggestions brought forward by the Secretary were discussed.

The following day, August 30, was mainly devoted to the reading and discussion of papers. Prof. Lash Miller, in an address on "The Need for Reform in the Education of Chemists," pointed out the great opportunities now available to university graduates through the progress of chemical industry, and emphasised the importance of the mathematical side of chemistry, particularly the branch of thermodynamics. The present methods of teaching chemistry in most universities were criticised by the author, who suggested that well-defined terms should be adopted in place of the vague expressions now in common use, that more attention be paid to thermodynamics, and that emphasis be laid on the fact that chemistry is but a description, classification, and record of observed facts. Details were then given of the methods of training now in use at the University of Toronto.

A paper on "Problems Encountered in the Development of the High-speed Paper Machines at the Laurentide Company's Plant at Grand'Mère and their Solution," by Mr. G. D. Kilberry, was read, in the author's absence, by Mr. J. N. Stevenson. It contained a full description of two machines erected recently to produce 75 tons of paper daily; these machines, which are driven electrically, make paper in sheets 146 inches wide at the rate of 1000 feet per minute, and their successful operation has proved the possibility of working economicaly at this high speed.

Mr. R. H. Clayton presented a paper on the "Action of Thiocyanate Solutions on Cellulose," by Mr. H. E. Williams, who showed that solutions of metallic thiocyanates for use as solvents of cellulose must have certain specific properties, viz., positive heat of solution, boiling point within certain limits, and high viscosity. Diagrams giving the correct conditions were discussed and calcium thiocyanate was shown to be the most suitable of the salts investigated. A solution containing calcium thiocyanate and calcium chloride gives excellent results. It was observed that when formaldehyde was added the cellulose was dissolved at a lower temperature. The application of the process to the production of artificial fibres, parchment paper, and mercerised cotton goods was discussed. Mr. A. L. Dawe then presented a kinematograph film illustrating all the stages in the manufacture of paper.

During the noon interval, Mr. H. W. Matheson, chairman of the Montreal Section, presided at a luncheon given at the Windsor Hotel by the Montreal Section, when the guests were addressed by Sir F. Williams-Taylor, general manager of the Bank of Montreal, and by Dr. C. H. Herty, past-president of the American Chemical Society. Both speakers urged closer co-operation between chemists and capitalists, as the future of industry largely depended upon the progress of chemistry.

Three papers were read at the afternoon meeting under the presidency of Mr. Wardleworth. In the first paper Dr. O. Maass dealt with the "Properties of Pure Hydrogen Peroxide" and described the preparation of anhydrous hydrogen peroxide from the commercial article of 3 per cent. strength. After neutralisation with alkali, peroxide of 35 per cent. strength is produced by distillation *in vacuo* at ordinary temperatures. By further concentration *in vacuo* the strength is brought up to 90 per cent., and from this the 100 per cent. product is obtained by fractional distillation. Anhydrous hydrogen peroxide is not explosive, but can be rendered so by the presence of very small percentages of impurities. A description of the properties of the pure product was given.

Dr. G. S. Whitby gave an account of "Observations on the Chemistry of Rubber" carried out at McGill University, and quoted interesting figures showing the effect of organic catalysts; further details will be published when the work is finished.

The third paper, on the "Manufacture, Properties, and Employment of Heat-Intercepting Glasses," was by Prof. Gellert Alleman, who traced the development of the industry from the production by Sir W. Crookes of glass that would screen out all ultra-violet rays to the manufacture and utilisation of the present-day article. Artificial biotite is the essential ingredient of these glasses, and their efficiency as heat and glare intercepters, as well as their high mechanical strength, renders them very suitable for building purposes. Samples of various types of these glasses were exhibited.

Banquet at the Engineers' Club.

One hundred and twenty-five members and guests attended the banquet which was held in the Engineers' Club on the evening of August 30. Sir William Pope, who presided, gave the toasts of H.M. the King and Canada, and the latter was responded to by the Hon. R. H. Dandurand, who said that in Canada progress was welcomed in all its forms, but little inclination had so far been shown for disinterested research work. The French-Canadian universities were somewhat behind the others in regard to equipment and staff in the science departments, but the French-Canadian system of education had grown from nothing; it had no home reserves to draw from. During the past 25 years, however, many students and young professors had been sent to Paris as well as to English universities, so that in future Canada would reap the advantage of having communion with the culture of two great nations instead of only with one as heretofore. Morally all was well with the whole of Canada, but economical conditions were still unstable. He could vouch for the future of the East, but that of the West, where so much development remained to be done, was a matter for hope. They had all been spending borrowed money and now were called upon to meet the bills, and he would urge the English visitors to tell their friends that Europe should give Canada a breathing space, just long enough, at any rate, to denationalise the railways.

Mr. Henry Holgate, in proposing the health of "The Society," said that he and his fellow Canadian members regarded the selection of Canada as the locality for the annual meeting and the election of a Canadian president as very great compliments. When he asked why he had been chosen to propose this toast, he was told that it was probably because he was not a chemical engineer. The reply had made him think, and he had come to the conclusion that chemical engineering was really at the basis of most things; that it was difficult to name any industry of which it was not either the mainspring or the entire foundation. This had led him to consider how the various kinds of engineers could be brought into closer co-operation. An engineer is usually regarded as a man who develops economically the resources of a country, but a famous railway engineer defined him as a man who could do for one dollar what another could do for two. The greatest conserver of natural resources had been the chemical engineer, both in avoiding waste and in utilising material that had been wasted.

Sir William Pope, in reply, regretted that so few overseas members were present to receive the tribute which had been extended to the Society. Practically all the men who had attended the last annual meeting of the Society held on the American continent had passed away. The Society of Chemical Industry was the oldest society in the world that sought to apply chemical science to industrial purposes, and it had served as an inspiration to a number of similar societies in other countries. The American Chemical Society had adopted almost without alteration the methods laid down originally by the Society of Chemical Industry, and such changes as had been introduced were inspired by the working methods of the Chemical Society of London. The extremely flourishing French Society of Chemical Industry was modelled entirely on the lines of the corresponding British Society. He was glad to think that our chemical-industrial ancestors had built better than they had thought; and he looked forward confidently to attending future meetings of the Society not only in the old country, but on the American continent, and more particularly, for personal reasons, in Canada.

Mr. Harold J. Roast, secretary of the Canadian Institute of Chemistry, then intimated that at its annual meeting held on the previous evening, the Institute had unanimously resolved to offer to Sir William Pope the honorary fellowship of the Institute in consideration of the many services he had rendered to the profession of chemistry. After Sir W. Pope had acknowledged the honour, Mr. F. W. Gamble proposed "The Canadian Sections and the first Canadian President." He recounted the steady progress of the Society in Canada, and congratulated the Sections on having decided to form a committee which would co-ordinate their work and act as a powerful organisation in looking after the interests of Canadian chemical industry as a whole. The selection of Dr. Ruttan was an admirable one both from the standpoint of Canadian chemistry and that of the Society.

Dr. Ruttan, acknowledging the toast, said he felt very much like the golfer who was playing a very difficult hole for the first time. He did not know where the hazards were, and had no idea of the extent of the risks; but although he did not know all the bunkers, he would try to play the game. His heaviest handicap would be the fact that he was succeeding Sir William Pope, who was so well acquainted with the problems that were facing chemistry in the universities and industries in England, and who was one of the most popular and efficient of all the great chemists who had filled the office of President of the Society. The present very successful meeting had been of especial interest inasmuch as it had drawn together chemists from the whole breadth of the continent, from Halifax to Vancouver, Alberta, Saskatchewan, New Brunswick, and Manitoba; in fact, every province had sent representatives to the meeting, and it had been a great pleasure, tempered with a certain amount of regret, to shake hands with a large number of Canadian members who had made their homes in the United States. They had learned in the universities and in the Research Council at Ottawa that to educate without creating opportunity was to offer a bonus for the export of national ability. This exportation was still proceeding, but they had had the good fortune to bring back to Canada Mr. Wright and Mr. Matheson, who had established the electro-products industry at Shawinigan and had succeeded in that wonderful undertaking, the synthesis on a manufacturing scale of acetone, acetic acid and aldehyde. They were proud of that fact, and also that many of the largest industries in the United States included young Canadians among their brilliant members.

Mr. T. H. Wardleworth said it was a sign of the greatness of the Society of Chemical Industry that it was able to disprove the saying of Rudyard Kipling that East was East, West was West, and never the twain would meet. It was particularly fitting that friends and members of the Society should meet in Montreal, which was the half-way house between East and West. In ancient times it was the practice of great empires to record upon their monuments the trophies and treasures which had been brought to their monarchs; the members of the Society were not called upon to bring silver and gold and precious spices, but they should regard it as their duty to bring as a tribute to the Society the results of their researches and labours. That was the object of the Society, and it should be the aim of every member. In proposing the toast of those who had journeyed to Canada from overseas, he assured them that none of the Dominion's boundless forests, the lakes of unplumbed depth, the broad prairies and the long rivers exceeded in length, breadth or depth the feeling with which they welcomed their guests on this occasion. In reply, Mr. C. S. Garland expressed the thanks of all the party for the kindness they had received, which made it certain that in future there would be at least twenty-five missionaries in England who would be a very strong bond between the two countries. Their visit to Canada would be one of their most cherished memories. Prof. K. C. Pandya said he had been overwhelmed by the kindness of his reception; he had never enjoyed himself so much before. He wished that there had been present more distinguished representatives of his country—India—than himself. He agreed with Mr. Wardleworth that Kipling's saying had been disproved; in the words of an Indian writer, East and West had always met on the ground of common humanity.

The toast of the American Section was proposed by Mr. W. M. Davies and responded to by Dr. W. Nichols, past-president of the Society, and Dr. R. S. Church, chairman of the American Section. Dr. Nichols referred to the address given by Dr. C. H. Herty that afternoon on the need of propaganda among the people. That was a very important matter. The science of chemistry lay at the foundation of the future prosperity of the world; the world did not know it; it did not appreciate it; but it must be made to know and appreciate it. The future of the world depended on research, and the question of the supply of professors to train the coming generation of research workers was one of the most important to be solved. Chemical industry on the American continent was being slowly and surely built up in such a way that, if given time, it would be able to withstand the assault of any combination of chemists in the world; but unless measures were taken in due time to enable the industry to consolidate its position, success would not follow, however great might be the expenditure of material and money. Given time, the Anglo-Saxon chemist would show himself to be the equal and, owing to his imagination and ingenuity, the superior of any chemists in the world.

Dr. Church said that he could not claim to have been present at the births of so many chemical societies as the last speaker, but he felt that at the present meeting he had attended what was practically a re-birth of one. He hoped that as a consequence of this meeting, Canadian and American members of the Society would be drawn together in closer contact, and that it might be possible to arrange for occasional joint meetings of the two Sections.

In proposing the toast of "Sister Societies," Dr. F. W. Atack said that to the younger generation of chemists, the literary work of the American Chemical Society was a revelation, and the efforts it was making to produce satisfactory monographs were worthy of all praise. The important task of convincing the man-in-the-street of the value of chemistry would be best undertaken by united action among the societies; we were tired of duplication and overlapping, and it was to be hoped that no more separate societies would be formed. Responding to this toast, Dr. W. A. Noyes, past-president of the American Chemical Society, said that the meeting of the American chemists at the grave of Priestley on August 1, 1874, might be regarded as the beginning of the American Chemical Society, and in that sense the latter society was older than the Society of Chemical Industry. In another sense the American Society was the younger as it had learned to copy good things, and it was not until it had initiated local sections and peripatetic meetings that it really began to thrive. Further, in establishing its Abstract Journal, the American Chemical Society had copied the admirable example of the Abstracts of the Society of Chemical Industry. Both societies had grown together, and now there was the most hearty feeling of co-operation and goodwill between them. In America they regarded the Society of Chemical Industry as one of their own societies; it was an international organisation of which America was just a part, and they would continue to help it, as they had done in the past.

The toast of the guests was given by Mr. C. R. Hazen and replied to by Colonel Gaudet. Finally, Sir William Pope called upon the overseas guests to drink the health of their hosts in Montreal, of the Montreal Section, and of the various committees which had worked with such great success, and Dr. Matheson responded.

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Mr. T. H. Wardleworth took the chair at the opening of the morning session on August 31, when Dr. C. E. K. Mees read his paper on the "Preparation of Synthetic Organic Chemicals." Dr. Mees said that the absence of supplies from Germany during the war led to a grave deficiency in the supply of research chemicals. The first attempt to meet this shortage was due to Prof. E. G. Derrick, who had the chemicals needed by the chemistry department of the University of Illinois prepared by students during the vacation. In 1918 the Eastman Kodak Co. entered the field, as the supply was very inadequate, and has since carried on the work. From a commercial standpoint the first year's operations were a failure, but it is expected that during the present year income will balance expenditure, owing to improved methods, lower costs, and the fact that more chemists are aware of the work being done. Following the reading of the paper, Dr. F. B. Power moved and Prof. Watson Bain seconded that "an expression of great appreciation be presented to the Eastman Kodak Co. for its public-spirited and generous work in developing the production of synthetic chemicals, as outlined by Dr. Mees." This resolution was carried with acclamation.

Mr. L. R. Thomson, in his paper on the "Briquetting of Lignite for Domestic Fuel," described the work carried out by the Lignite Utilisation Board on the utilisation of lignites in the Canadian North-East for the manufacture of briquettes, the process consisting essentially in carbonising the raw material and then briquetting with coal-tar pitch. The average composition of the finished product is as follows:—Moisture, 4·3, fixed carbon 59·8, volatile combustible matter 19·4, and ash 16·5 per cent.; and it yields 11,280 B.Th.U. Briquettes now made at the Government plant at Bienfelt, Saskatchewan, are much more economical for domestic purposes than imported American anthracite.

In his paper on "The Recovery of Peat by Air-Drying," Mr. E. V. Moore reviewed the various methods for preparing peat and pointed out that air-drying constituted the only economical method. Peat contains a large percentage of matter in what is practically a colloidal state, and in expressing the water mechanically the effluent contains almost as much solid matter as the residue. The author described the Government plant near Ottawa, where the moisture content of the peat is reduced from 90 to 30 per cent., and stated that the householder would benefit materially if he replaced 20 per cent. of his anthracite with peat. At the conclusion of the paper a film was projected depicting the operations of the Peat Board at Alfred, Ontario.

Owing to the lateness of the hour papers by Dr. Watson Bain on "Theoretical Considerations on the Hargreaves Process," and by Prof. E. G. R. Ardagh on "Activated Carbon" were taken as read. Prof. Ardagh's paper deals more especially with the methods for increasing the adsorptive power of amorphous carbon and shows that considerable progress has been made in this field during the last ten years. The results of his investigations on the preparation of such carbons from hard maple sawdust confirm those obtained by Zerban and others. The author made several suggestions that should yield profitable results in future work. He laid special strees on the work of Dr. N. K. Chaney, of the United States Chemical Warfare Service, which has thrown an entirely new light on the causes of activity in carbon.

Mr. F. J. Hambly presided at the luncheon at the Windsor Hotel, at which the Hon. Jacques Bureau, M.P., was the guest of honour. Mr. Bureau, in welcoming the delegates to the Province of Quebec, described the enormous power developed and the paper industries established in the St.

Maurice valley, and hoped that chemists would soon provide a solution to the waste sulphite-liquor problem. Mr. C. S. Garland replied.

A special convocation of McGill University was held in the afternoon in the Royal Victoria College when the honorary degree of Doctor of Laws was conferred upon the President, Sir William Pope. In presenting Sir W. Pope, Dr. Ruttan briefly reviewed his career and paid tribute to his brilliant investigations in the most difficult fields of organic chemistry. The President, in acknowledging the honour conferred upon him, recalled his intimate friendship with Prof. Nicholson, Sir E. Rutherford, the late Prof. Harrington, and other members of the University staff, and observed that the absence of traditional reserve was in favour of more perfect co-operation between Canadian universities and industries, whereas in England the lack of precedent hindered the realisation of such relations.

After the ceremony a garden party was held in the University grounds, and, favoured by ideal weather and sunshine, nearly 300 persons attended.

At the close of the meeting the overseas visitors, accompanied by their American colleagues and many members of the Montreal Section, left for Shawinigan Falls at 11.20 p.m., *en route* to Ottawa, Toronto, and New York.

CHEMISTRY AT THE EDINBURGH MEETING OF THE BRITISH ASSOCIATION.

The eighty-ninth meeting of the British Association eclipsed all the meetings held in recent years both in interest and popularity. The fact that the attendance of 2768, which has been exceeded only on eight previous occasions, was composed of approximately equal numbers of visitors and local residents, shows that the success of such gatherings is conditioned as much by the intellectual character of the environment and by efficient local organisation as by other circumstances of a more internal kind. With the passing of the war period, there is every prospect of continued success, wherever the meetings may be held—in Hull in 1922, in Liverpool in 1923, and in Canada in 1924.

Section B (Chemistry), presided over by Dr. M. O. Forster, shared to the full in the general success, the presidential address (*cf.* J., 1921, 324 R) and the two joint discussions, in particular, drawing very large audiences. The keynote of the proceedings was "vitality": the chemistry of vital phenomena formed a very conspicuous part of the programme, and the vitality of the president contributed very largely to the vivacity of the proceedings. If a minor criticism may be permitted, it is that perhaps in future a little more might be done to interest and enlighten those members who are not specialists in natural science. Unlike the average learned society, the British Association has the opportunity of "getting at" the more intelligent man-in-the-street, and in these days of democracy it is becoming more and more clear that, by means of lucid and non-technical exposition, he must be given an insight into the methods and results of science, in order that he may realise both their intrinsic value and their vital importance to national welfare. There can be no doubt, however, that the programme of Section B was highly successful in attracting a very large number of chemists and members of allied Sections. No one with previous experience of the Section could have left the meetings without the thought that its youth had been renewed and its utility enhanced. A valuable and interesting adjunct to the proceedings was the programme of visits to laboratories and works, among which may be mentioned the new University Laboratories at Liberton, the Heriot-Watt College, the North British Rubber Co., the breweries of Messrs. Wm. Younger and Co., the works of Messrs. Duncan, Flockhart and Co. (fine chemicals), the Pumpherston Oil Co., and the wire mills of Messrs. Brunton at Musselburgh.

After the delivery of the Presidential Address on September 8 (*cf.* J., 1921, 324 R), Prof. R. Robinson outlined a new hypothesis of "The Genesis of Plant Pigments and Related Substances." Two types of naturally occurring substances containing a C_{15}-nucleus can be distinguished: those related to the sesquiterpene series and probably derived by polymerisation of three isoprene molecules, and those which may be regarded as condensation products of carbohydrates. Santonin belongs to the former class, but most plant pigments belong to the latter. The molecules of the flavones, flavonols, anthocyans and related substances contain two aromatic nuclei (A and B) which exhibit a varying state of oxidation in different members of the series; nucleus A is normally present as a derivative of trihydroxybenzene and nucleus B as a derivative of dihydroxybenzene. These conclusions follow directly from the author's hypothesis, of which the main tenet is that each nucleus is derived from a hexose, and that the latter is connected by aldol-condensations with glycerose (dihydroxyacetone). Brasilin and hæmatoxylin are derived by introducing a molecule of formaldehyde into the complex, and the relation resembles that which obtains between the papaverine and berberine groups. The hypothesis is also applicable to plant pigments of the naphthalene and anthracene series.

The Structure of Molecules.

The joint discussion on this subject between Section B and Section A (Mathematical and Physical Science) was opened by Dr. Irving Langmuir, who explained in detail the theory of atomic structure proposed by Prof. G. N. Lewis and further developed by himself. The theory regards the atom as composed of a small positive nucleus, containing (i) a number of unit positive charges, each of mass approximately equal to that of the atom of hydrogen, and (ii) negative electrons, of very small mass. The number of positive charges is thus approximately equal to the atomic weight of the element, whilst the excess of the positive over the negative units, or the net positive charge on the nucleus, is the atomic number of the element, which is the number of its position in the periodic system, counting hydrogen 1, helium 2, lithium 3, etc. Since the whole atom is electrically neutral, a number of electrons equal to the net charge on the nucleus, or to the atomic number, must be distributed around the nucleus, and at a relatively large distance from it. So far, the theory had previously been developed by Rutherford, Mosely, and others. Bohr supposed the outer electrons to be revolving in orbits, and on his assumption was able to explain the production of spectra. G. N. Lewis assumed the electrons to be practically at rest, and his idea has been largely developed by Langmuir, who has explained the forces of valency on this basis. In the simplest form of the theory, recently developed, three fundamental "postulates" are assumed, from which the observed facts of chemical combination are deduced. The electrons in the outer shell tend to form stable groups of 8 ("octets"), and electrons may be shared by pairs of atoms to form octets around the compounds. Thus, sodium has eleven outer electrons, arranged in groups of 2, 8 and 1. Chlorine has 17 outer electrons, in groups of 2, 8 and 7. In combination, the 7 outer electrons of the chlorine and the 1 outer electron of the sodium form a stable octet. In sharing the electron of the sodium, however, the chlorine atom becomes an ion, and the sodium atom an ion, so that in sodium chloride we have the ions Na^+ and Cl^- ready formed, and there is no "bond" such as would be represented by Na—Cl. This is an example of "electrovalency." In the formation of non-polar molecules, such as H_2, a *pair* of electrons form a coupling or "covalency," and this is properly represented by a bond, H—H.

Prof. W. L. Bragg spoke on the light thrown on the atomic structure of crystals by the reflexion of X-rays. The atoms (or ions) in crystals are arranged in planes of greater density, revealed by their power of reflecting the rays. In this way it was possible to determine how the atoms were arranged and the distances between them. It appeared that common salt, for example, consisted of sodium and chlorine ions arranged in a cubical pattern, not of sodium chloride molecules. It was possible to calculate the volumes occupied by the atoms in solid crystals. Recent work seemed to indicate that the outer electrons were more closely clustered about the nucleus than would be expected on the Langmuir theory, but on the whole that theory was confirmed.

Prof. A. O. Rankine pointed out that there was a close relation between the outer structures of some molecules and those of atoms of inert gases, the latter also being surrounded by octets. From measurements of the viscosities of gases the sizes of the molecules could be calculated, and these were in agreement with Langmuir's theory.

Prof. S. Arrhenius, of Stockholm, observed that at the present time the difficulties of accepting the existence of ions had so far disappeared that the presence of ions was now postulated in places, *e.g.*, solid crystals, where they were not formerly assumed. The idea that *two* electrons were necessary in the formation of a covalence bond, which was formerly regarded as a single line of force, introduced some difficulties.

Prof. A. Smithells, Prof. J. R. Partington, Dr. S. C. H. Briggs, and Dr. E. K. Rideal also took part in the discussion.

On the following morning, Prof. H. E. Fierz, of Zürich, who has a long and intimate acquaintance with the Swiss dye-industry, read a paper on "The Modern Dyestuff Industry," in which he took a somewhat pessimistic view of its immediate future. The capital now invested in the industry is too large to enable it to furnish adequate returns, competition is very keen, there is considerable over-production, and the main road to prosperity lies in modifying and extending existing plant for the production of materials other than dyestuffs.

On September 12, the Section held a joint discussion with Section I. (Physiology) on

Oxidations and Oxidative Mechanism in Living Tissues.

The subject was introduced by Prof. F. Gowland Hopkins in a paper which dealt with the requirements, methods, and claims of biochemistry in its relation to organic chemistry. The problems of biochemistry were illustrated by reference to investigations on the oxidations which form such a characteristic feature of the chemical activities of living tissues. The elucidation of the constitution, or the discovery of methods for synthesising substances of biochemical importance is not the sole, or even the principal aim of biochemical research; dynamic problems which involve a study of the stages of biochemical reactions are always in the foreground. At once the worker is in presence of a dilemma, because ordinary chemical methods must often be barred in dealing with actually living tissues; only indirect methods of attack can be used in such cases.

The oxidation of fats.—It has been shown that straight-chain fatty acids are broken down two carbon atoms at a stage, by what is termed β-oxidation. By feeding animals on phenyl-substituted fatty acids, Knoop found that the derivatives of fatty acids with an even number of carbon atoms all gave in the urine the same simple derivative of benzoic acid, viz., benzoyl glycine, whilst those with uneven numbers of carbon atoms all gave a derivative of phenylacetic acid (phenylacetylglycine). The explanation was that in both cases the chain was shortened by two carbon atoms at each stage, and this β-oxidation was repeated until the resistant phenyl-group came to lie either in the α or in the β position to the carboxyl group, so that further oxidation could not occur, when the residue (respectively, benzoic or phenylacetic acid) was excreted without further change beyond condensation with glycine. Embden obtained further and more direct evidence by studying the changes undergone by fatty acids when perfused through a freshly excised liver; all those fatty acids with an even number of carbon atoms (*i.e.*, all the fatty acids occurring in nature) passed ultimately through the 4-carbon stage of aceto-acetic acid, whilst those with uneven numbers did not yield this product. The fate of the 2-carbon groups removed at each stage of the oxidation is still obscure.

Oxidation of carbohydrate.—Direct oxidation of carbohydrate, if it occurs at all, is the exception; most commonly some intermediary substance, such as hexose phosphate, is formed, which is then converted, by non-oxidative processes, into lactic acid, and it is this substance which is then subjected to oxidation with formation of carbon dioxide and water. The relations of lactic acid to the contraction and recovery of muscle have been studied by Fletcher and Hopkins, and more recently by Meyerhof. The lactic acid produced during contraction is subsequently partially oxidised during the recovery process; if the muscle be kept under anærobic conditions the lactic acid accumulates until, by the establishment of an equilibrium, a maximum has been reached. But even in presence of oxygen, not all the lactic acid is removed by oxidation; only about one-quarter of it is so removed, the remainder being re-converted into carbohydrate, with a corresponding storage of energy.

Oxidation of proteins.—The amino-acids derived from the proteins suffer various fates in the body, but a common fate is de-amination; the fate of the de-aminised residue depends a good deal on its structure—that of the indol ring derived from tryptophane may be mentioned as an example. In the dog the tryptophane derivatives are excreted as kynurenic acid, so that by feeding dogs with various supposed intermediary products, an excretion of these in the form of kynurenic acid would suggest that those substances were actual intermediaries in the normal tryptophane metabolism. Indol-lactic acid did not yield kynurenic acid, and was not to be regarded as an intermediary product, but the corresponding keto-acid, indol-pyruvic acid, since it was converted into kynurenic acid, was a probable stage in the normal tryptophane metabolism in the dog.

Mechanism of oxidative changes.—In recent years there has been a growing tendency to regard oxidative processes as associated with the activation, not of oxygen but of hydrogen, after the manner suggested by Wieland. In these hydrolytic oxidation-reductions, the hydroxyl group of water can be used to oxidise an oxidisable substance (oxygen acceptor), provided that there be present another substance capable of taking up the hydrogen (hydrogen acceptor); the catalyser which brings about this oxydo-reduction is present in tissues, and a similar one, the Schardinger enzyme, is present in milk. Xanthin and hypoxanthin are oxidised to uric acid by milk in the presence of methylene blue, which acts as a hydrogen acceptor and is converted into the colourless reduction product. Various substances can act as hydrogen acceptors : substances like methylene blue, which are reduced, or oxygen which forms water, the latter being the mechanism of the ordinary oxidative processes in living tissues.

Prof. Hopkins has recently been able to isolate from animal tissues, and also from yeast, a substance that can act as a hydrogen acceptor, when in the oxidised form, and which is an autoxidisable substance when in the reduced form. It is a dipeptide composed of glutamic acid and cystëin when reduced: after oxidation the $-SH$ groups of two molecules are converted by loss of hydrogen into an $-S-S-$ group, so that the molecular weight of the compound is doubled, and it is then a cystine derivative. This substance can be removed from tissues by washing, with the result that the tissue can no longer rapidly reduce methylene blue. When the disulphide is added the reducing power is restored. It thus acts as a co-ferment, accelerating the transfer of hydrogen to the hydrogen acceptor (methylene blue). The hydrogen donator (oxygen acceptor) can be lactic acid, which is converted to pyruvic acid.

In the discussion, Dr. C. Lovatt Evans, referring to the great importance of Prof. Hopkins' recent discovery, gave an account of the physiological phenomena of cyanide poisoning, which had led him to the belief that cyanides, which exert their effects by depressing the oxidative processes, did so by interfering in some way with the sulphydryl groupings of the tissues; Prof. Hopkins' discovery had not then been made, but might now throw light on this problem. Prof. Hopkins, in reply, stated that he had also at first held the same opinion, but had been so far unable to obtain confirmatory evidence. Prof. R. Robinson, referring to the β-oxidation, said that such modes of oxidation also had their parallel in laboratory experiments, and that Lapworth's view of the alternate positive and negative charges on the carbon atoms in a chain might provide an explanation. Prof. A. V. Hill spoke on the heat production in muscular contraction as a means of studying the oxidative removal of lactic acid.

Synthesis of Formaldehyde and Carbohydrates from Carbon Dioxide and Water.

Prof. E. C. C. Baly gave a short account of the work he has recently done on this subject in conjunction with Prof. I. M. Heilbron and Mr. W. F. Barker.

It has been found possible to initiate and carry out a photochemical reaction by mixing with the reactants a substance which absorbs light of wavelength different from that absorbed by the reactants, provided that this substance possesses the same infra-red frequencies as those of the reactants. The process, which has been called "photocatalysis," consists in the absorption of light by the photocatalyst, the energy being radiated at the infra-red frequencies. This radiated energy is reabsorbed by the reactants, with the result that the required reaction takes place.

This has been successfully applied to the photosynthesis of formaldehyde from an aqueous solution of the carbon dioxide which normally requires ultraviolet light of very short wave-length, such as is not present in sunlight. An aqueous solution of a coloured base, *e.g.*, malachite green, saturated with carbon dioxide, gives formaldehyde on exposure to visible light. The combination of the carbon dioxide with the base ensures the identity of infrared frequencies.

On exposure to long wave-length ultra-violet light formaldehyde in aqueous solution is polymerised to carbohydrates. Direct photocatalysis of this reaction has not yet been accomplished, but analogous experiments prove that it will take place in the presence of a coloured substance which forms an addition compound with formaldehyde.

In the light from the quartz mercury lamp, aqueous solutions of acetone and of oxalic acid give both formaldehyde and carbohydrates, thus proving that carbohydrates are directly photosynthesised from carbon dioxide with formaldehyde as an intermediate product.

The chlorophyll in the living plant acts as an ideal photocatalyst. It absorbs visible light, it combines with carbonic acid, and it retains within the complex the formaldehyde when formed. The synthesis therefore of carbohydrates from carbon dioxide and water in the living plant passes through both stages without the formation of free formaldehyde. The energy necessary for the two stages is absorbed in the form of visible light by the chlorophyll.

Other Papers.

A paper on an allied topic, "The Decomposition of Simple Organic Acids by Ultra-violet Radiation," was presented by Prof. F. M. Jaeger, of the University of Utrecht, but owing to lack of time was not read. In this paper the author describes experiments on the action of ultra-violet rays from a mercury-arc on aqueous solutions of simple organic acids and their salts, and he shows that the course of the reaction for each substance under given conditions of radiation depends to a great extent upon the presence or absence of special ions, which appear to act as directing catalysts. On September 13 the same author read a paper on "The Measurement of Surface Tension over a wide range of Temperature," in which he described a method for accurately determining surface tension between −80° and +1625° C. A slow current of nitrogen enters the liquid through a platinum capillary immersed to a known depth, and the minimum pressure required to burst the gas bubbles so formed is measured. This was followed by a contribution on "The Surface of Liquid Steel" by Mr. Cosmo Johns. The author had been struck by the fact that molten steel, particularly at high temperatures, retains its lustre, whereas the solidified metal rapidly oxidises, and a series of experiments showed conclusively that the immunity possessed by the molten product is due to the protective action of its own vapour. Prof. C. H. Desch gave a short account of "Surface Tension in the Solidification of Metals." The close correspondence that exists between the form of the grains in solidified metals and those of foam cells indicates that the form of the grain boundaries is determined by surface tension.

The concluding papers dealt with atmospheric pollution. Dr. J. S. Owens described some of the results obtained in measuring the suspended impurity in city air by filtering through white paper and comparing the resulting discoloration due to dust with a calibrated scale of shades. Tests on London air showed that this is purest between 12 p.m. and 6—7 a.m.; that the impurity is greatest at the time when domestic fires are lighted; and that it decreases thereafter, except for a rise between 4 and 5 p.m., falling rapidly about the time when fires are let out. Since the amount of impurity is approximately the same on Sundays and week-days, it is concluded that the closing of factories on Sundays makes very little difference, and that domestic smoke is the chief delinquent. The ratio of factory smoke to domestic smoke is approximately 1:2 in London. A notable decrease in the amount of suspended impurity was observed during the recent coal strike. Normally there is about 1 mg. per cb. m of suspended impurity in London air, but during a fog it may rise to 4 mg. per cb. m. It is calculated that the domestic fires of London produce over 200 tons of soot during winter mornings between 6 a.m. and 9 a.m., and that such an amount would suffice to produce a dense smoke fog. The author is now working out a new and very sensitive method of measuring suspended impurity by causing a small jet of air to strike against a glass surface which can be removed, mounted for microscopic examination, and preserved for reference. Under the microscope it is found that the particles suspended in London air are black and measure from 0·25 to 1μ; such very finely divided particles have practically the same penetrating power as a gas. In opposition to the common belief that expired air is free from suspended matter, the author has found that about 70 per cent. of the sooty matter inhaled with London air is exhaled during ordinary breathing.

Mr. William Thomson, of Manchester, discussed the polluted condition of the air in that city. It was calculated that about £1,000,000 was lost annually through the smoky atmosphere, and that the sum required for cleaning chimneys alone was not less than £100,000. It would pay Manchester to invest £10,000,000 in smoke-prevention. The solution, he thought, was to use a smokeless fuel in domestic grates.

On the afternoon of the first day Prof. G. Barger gave a demonstration of the micro-analysis of compounds containing carbon, hydrogen, and nitrogen.

Reports and Committees.

The report presented by the Fuel Economy Committee was a very short one, owing to the recent severe illness of its chairman, Prof. W. A. Bone. It states that a majority of the committee was in favour of restricting the carbon-monoxide content of coal gas to 20 per cent., and then discusses such economic questions as the cost of producing coal, output, and the necessity for exploring sources of supply of fuel-oil as an insurance against future crises in the production of coal. The committee was reappointed for a further year. A short report was also presented by the Committee on Non-aromatic Diazonium Salts. The committees on Colloids and Absorption Spectra were reappointed, and a new committee was set up to co-operate with the Carnegie Trustees in compiling an annotated index of chemical literature for use in connexion with their Rural Library Scheme.

At the close of the proceedings a message was sent to Prof. A. Crum Brown recalling his former connexion with the Section and with the teaching of chemistry in Edinburgh.

MANUFACTURE OF ACETIC ACID.

Extensive developments have taken place of recent years in the manufacture of acetic acid from calcium carbide through the intermediate production of acetylene and acetaldehyde. Large quantities of acetic acid were made in this way during the war period to supplement or replace supplies normally obtained by the distillation of wood. Thus, in one year, the Canadian Electro-Products Co., at Shawinigan Falls, produced nearly 20,000 tons of glacial acetic acid, and in Germany Meister, Lucius und Brüning operating a plant with an estimated capacity of 20,000 t. per annum succeeded in producing from 10,000 to 12,000 t. per annum. In addition, a relatively small amount of acid was made by the Griesheim-Elektron Co., and processes of manufacture were patented by both F. Bayer and the Badische Anilin- und Sodafabrik. Several French companies are interested in the matter, and in this country the British Cellulose and Chemical Manufacturing Co. has produced acetic acid from calcium carbide. In England, however, manufacture has been suspended on account of high operating costs and the comparative cheapness of the imported acid.

The synthesis of acetic acid is thoroughly worked out and capable of application on a large scale, but the ability of the process to meet competition from the wood-distillation industry depends entirely upon economic considerations, especially the cost of calcium carbide. At present prices, the cost of carbide in Great Britain would throw a burden of £60 upon each ton of acid produced, whereas the market price of glacial acetic acid varies from £70 to £72 per ton. Since the manufacture of one ton of synthetic acid requires two tons of carbide, and as the production of one ton of carbide consumes power exceeding 4000 kw.-hrs., it is obvious that a country which possesses cheap hydro-electric power will have the advantage over one where power is developed from coal. Thus it is stated by a Norwegian authority that prior to 1914 the cost in power for the production of a ton of carbide in Norway was as low as 25s. in many instances.

Acetic Acid from Pyroligneous Acid.

Acetic acid is relatively stable, in the absence of catalysts, at the high temperatures obtaining in the destructive distillation of wood. In an ordinary operation upon hard wood, about 40—50 per cent. of the weight of the air-dried wood taken is obtained in the form of "pyroligneous acid," an aqueous distillate containing approximately 80 per cent. of water, 3—4 per cent. of methyl alcohol, and 6—8 per cent. of acetic acid; the acid is of a brown colour due to the presence of wood tar. The crude pyroligneous acid is distilled, often in multiple-effect apparatus, in order to eliminate the wood tar, and the acetic acid is neutralised by means of milk of lime. The methyl alcohol may then be distilled and rectified. Many varieties of apparatus are, of course, available, but an economy results if the milk of lime is contained in closed tanks situated between the stills and the condensers for aqueous alcohol. Similarly, the preliminary distillation for the purpose of tar removal may be eliminated by a system of tar-scrubbers arranged before the condensers in the original wood-distillation system. The "grey" acetate of lime obtained from "clean" pyroligneous acid is mixed with strong sulphuric acid and distilled *in vacuo* from a cast-iron still, pure acetic acid being obtained. Here again great advances upon the original types of stills have been effected, and mention may be made of recently-patented apparatus, in which the mixture of calcium acetate and sulphuric acid is decomposed upon the surface of a heated revolving iron cylinder, the calcium sulphate formed being continuously removed by scrapers, and the acetic-acid vapours drawn to condensers. The crude acid thus obtained requires concentration and purification, as it contains propionic and butyric acids, sulphur dioxide, and up to 20 per cent. of water. Rectification is effected in copper stills, the first and last runnings being collected separately, and glacial acetic acid of 99—99·5 per cent. purity is obtained after about a third of the charge has been distilled.

Considerable importance also attaches to the methyl alcohol produced from the pyroligneous acid, for as long as no commercially-practicable method of synthesis or other source of the alcohol is available, it may be made to bear the expense incurred in selling the acetic acid at "cut" prices in order to meet competition from the synthetic product. Synthetic acid, therefore, must be sold at a figure well below present market values if an economic battle with the wood-distillation product is contemplated. Evidence of this is to be found in the United States, as official statistics for 1919 show that the price of methyl alcohol has increased almost threefold since 1914, whereas that of acetate of lime has risen relatively little, the prices for the two compounds in 1919 and 1914 being \$1·23 and \$0·43 per gall. and 1·76 and 1·31 cents per lb., respectively.

Acetic Acid from Calcium Carbide.

There are three stages in the manufacture of acetic acid from calcium carbide, viz.:—(1) The generation of acetylene and its purification; (2) the catalytic hydration of acetylene to form acetaldehyde; and (3) the oxidation of the latter to acetic acid. Theoretically, 64 parts of calcium carbide will yield 60 parts of acetic acid. Assuming, however, an 80 per cent. yield in each of the three stages—and this is a fair average, a little less than this yield of purified acetylene being obtained in stage (1) when ordinary commercial carbide is employed, and usually more than this yield in stage (3)—it follows that the production of one ton of glacial acetic acid requires about 2 tons of carbide. This figure will be assumed in discussing the costs.

Calcium Carbide and Acetylene.

Details of the construction and operation of carbide furnaces and acetylene generators cannot be given here, but reference may be made to a paper by Deschiens (Chim. et Ind., 1921, p. 129) in which a very full description of the latest types of such apparatus is given. The types of acetylene generators may be broadly classified as continuous and discontinuous, and it is noteworthy that the former class often yields less acetylene per unit of carbide consumed, owing to the greater amount of water used and the lower temperature of operation. The solubility of acetylene in the lime water produced is of the order of 0·5—0·8 litres per litre of solution at about 40°—60° C. As the amount of water used in the continuous generators of the type employed by the Canadian Electro-Products Co., amounts to 52·5 litres per kg. of carbide treated, the loss of acetylene by solution is much greater than when using the discontinuous generators, which require only about 6 litres of water. The acetylene generated from commercial calcium carbide contains sulphuretted hydrogen, ammonia, arsine and phosphine. The removal of the first two presents little difficulty, but to obtain efficient purification the phosphine and arsine must be oxidised. Cupric chloride, hypochlorites, ferric oxychloride, chromium trioxide, hydrogen peroxide and the like have been suggested, and a new agent which can be regenerated is finding favour in France. This compound, "Catalysol," contains several of the above-mentioned oxidants, with manganese oxides, and mercurial salts. Reports as to its value are not yet available, but it is stated that negotiations for its use, in place of chromium trioxide or hydrogen peroxide, are being carried on by Meister, Lucius und Brüning.

Acetaldehyde from Acetylene.

The hydration of acetylene in the presence of sulphuric acid was first observed by Lagermark and Eltekow (Ber., **10**, 637), and the catalytic influence of mercuric bromide was noted by Kutscherow (Ber., **14**, 1540). In present-day manufacturing methods, the pure acetylene is passed into a solution of mercuric sulphate in sulphuric acid, vigorous agitation being maintained. The processes of the Canadian Electro-Products Co., of the British Cellulose Co. (Dreyfus), and of Meister, Lucius und Brüning differ slightly in detail. The Dreyfus process (E.P. No. 105,064), however, is discontinuous, and the formation of the aldehyde and its removal from the solution are carried out at different temperatures, namely, at about 40° and 60° C., respectively. The amount of catalyst, HgO, originally added may vary between 0·25 per cent. and 6 per cent., but should be so adjusted that the maximum yield of aldehyde per unit of catalyst employed results, together with maximum speed of absorption of acetylene. A current of acetylene is passed rapidly through the solution, the unconverted gas serving to carry the aldehyde from contact with the acid solution to the condensing and scrubbing systems; the acetylene is deprived of its aldehyde content in the water scrubber and is used again in the process. The aldehyde condensed in the brine-cooled condensers and the aqueous solution from the scrubbers are rectified in column stills and only absolutely pure aldehyde passes to the oxidation stage. The most serious difficulty to be overcome in the working of the hydration process is the decline in activity of the mercuric catalyst by reduction to a mercurous sludge containing free mercury. Further absorption of acetylene at this stage is uneconomical, and attempts have accordingly been made to maintain a constant activity of the reacting solution by adding fresh catalyst from time to time, as in the Canadian process, or by adding to the original acid solution ferric sulphate, which is reduced in preference to the mercuric sulphate (Meister, Lucius und Brüning). In any case, however, the mercury sludge must be removed in the end, and in the Canadian process it is regenerated by electrolytic oxidation. In the German process, the solution of ferrous sulphate and semi-colloidal mercury sludge is treated in separate vessels with strong nitric acid. The amount of aldehyde obtained under the best conditions, before regeneration of the mercury catalyst becomes necessary, is relatively small, and a considerable improvement seems to have been made by Hilditch and Crosfield (E.P. Nos. 124,702, 125,926, and 131,084), who pass acetylene into a solution of HgO in sulphuric acid containing ferric sulphate; the solution is kept agitated by the rapid movement of the stream of gas, and the aldehyde passes off with the excess gas. After a time, the rate of aldehyde production slackens, owing to the reduction of the mercuric catalyst, and at this stage an oxidiser is added. For this purpose hydrogen peroxide, salts of permanganic acid, pyrolusite, lead peroxide, cerium peroxide, etc. may be utilised, but it is preferred to employ one of the solid, water-insoluble oxidants, since reduction by the acetylene, etc. does not take place as is the case with the soluble oxidants. Thus, a reacting solution consisting of 200 c.c. of 20 per cent. sulphuric acid, containing 1 per cent. of mercuric oxide and 5 per cent. of ferric sulphate, will yield 489 grm. of aldehyde in 30 hours if 11 additions of 2 grm. of pyrolusite are made at intervals when absorption of acetylene slackens. This rate of production, equal to about 9 tons per day in a 1000-gallon "kettle"—the standard size in use in the Canadian works—represents a rate of production well in advance of that attained either in Canada or Germany.

Conservative figures based on the latest information are appended, showing the estimated costs of producing aldehyde, but exclusive of the cost of acetylene; the figures represent shillings per ton of aldehyde produced:—

	Shillings per ton.
Sulphuric acid, in solution, and reacting with pyrolusite	25
Pyrolusite, ferric sulphate, regeneration of HgO ..	20
Labour	10
Steam for distillation and rectification	5
Electrical power at 1d. per kw.-hr.	10

Thus, the total cost of producing a ton of aldehyde exclusive of charges such as interest on capital and depreciation, and not including cost of carbide, is 70s.

Acetic Acid from Acetaldehyde.

The oxidation of acetaldehyde to acetic acid by means of air or oxygen is carried out in the presence of a catalyst which not only accelerates the absorption of oxygen, but also decomposes the per-acetic acid produced as an intermediate compound, so that dangerous quantities of this unstable substance do not accumulate. Manganese acetate is universally employed for this purpose, although many catalysts have been suggested. There is little variation in the industrial application of this reaction by the various manufacturers of synthetic acid. The pure acetaldehyde is contained in an aluminium-lined pressure vessel or "kettle" which may or may not be fitted with means for agitation. Inlets for air and outlets for nitrogen containing a certain quantity of vaporised acetaldehyde are provided, and various pressure gauges, thermometers, air meters, etc. are suitably affixed. The outlet nitrogen-main passes to two condensers in series, the first being water-cooled, and the second brine-cooled. From the second condenser, pipes lead the nitrogen, deprived of the greater part of its contained acetaldehyde, to water scrubbers, where the aldehyde is totally recovered. Working temperatures and pressures may vary over a wide range if absolutely pure aldehyde is used, and it is only advisable that the pressure should suffice to raise the boiling point of aldehyde above the temperature of operation chosen. Thus, the Canadian Electro-Products Co. gradually raises the working temperature to about 60° C., a pressure of five atmospheres being applied to the aldehyde-acid mixture in the "kettle." The reaction is strongly exothermic, and internal or external cooling is necessary. Large quantities of aldehyde are carried away by the escaping nitrogen, particularly in the initial stages of the oxidation, but the two condensers suffice to liquefy a large part and return it by gravity to the kettle, the pressure being maintained to a point beyond the second condenser. Ultimately, an acid of about 93—95 per cent. concentration is obtained, and then the converters are discharged into storage tanks or into rectifying stills. It is usually found that the weight of acid obtained is approximately the same as that of the aldehyde charged to the converter, roughly one-quarter of the original aldehyde having been carried past the second condenser, or lost in operation. The nitrogen that escapes from the scrubbers is collected and used for maintaining an inert atmosphere in the converters during charging operations. The manganese-acetate catalyst may be recovered prior to rectification of the acid, or from the distillation residues.

The cost of manufacture of acetic acid from acetaldehyde is fairly low, and apart from the cost of aldehyde and repair charges, interest upon capital and depreciation, should not exceed 50s. per ton of acid produced. This figure includes the cost of 125 kw.-hrs. at 1d. per unit for compression of the 50,000 cb. ft. of air required, and for refrigeration. The cost of labour employed in connexion with the oxidation reaction, rectification of acid, and catalyst recovery, together with the cost of catalyst lost, is also included.

The Outlook for Synthetic Acetic Acid.

The manufacturing costs per ton of acetic acid produced are thus £6 if the cost of producing acetylene from calcium carbide be not included. Continual improvement is taking place in the construction of acetylene generators, so that it is difficult to estimate this figure, but it is not very high. In addition, the interest and depreciation charges, together with an allowance for repairs, will absorb at least £6 per ton of acid produced, as a plant with a yearly capacity of 10,000 tons costs £250,000. The manufacturing and all other charges, with the exception of cost of calcium carbide, can be placed at £15 per ton of acid produced. With carbide costing £29—£30 per ton—the English price in June, 1921—the total cost of producing synthetic acid could not be less than $2 \times 29 + 15$ or £73 per ton, a figure higher than the present market price of glacial acetic acid. Therefore the synthetic acid obviously cannot compete with acid from wood distillation in England under present conditions. In countries which possess adequate supplies of water power the case is different. Calcium carbide was manufactured in Norway before the war at a cost of £8 per ton, and it must be remembered that Norway is not well situated in respect of coal and lime supplies. If a return to this figure could be made in any country, synthetic acetic acid could be produced at a price which would allow of competition with the wood-distillation product. However, unless the demand for acetic acid increases—the development of the cellulose-acetate silk industry, the synthetic drug industry, and the production of chloracetic acid for use in indigo manufacture may be cited as possible outlets—the wood distillers will probably be able to supply the world's requirements, and will offer extremely keen competition, unless they have to fight an economic battle with the producers of synthetic methyl alcohol. In such a case the profit upon methyl alcohol would not be sufficient to allow of a subsidy being placed to the acetic-acid side of the wood-distillation accounts.

MEETINGS OF OTHER SOCIETIES.

THE IRON AND STEEL INSTITUTE.

The autumn meeting was held in Paris from September 5—10, under the presidency of Sir Hugh Bell. The Institute was the guest of the Comité des Forges de France, whose president, M. de Wendel, opened the meeting with an address of welcome. A number of papers, mainly by French members of the Institute, were read and discussed.

Monsieur P. Nicou described "The Iron-ore Deposits of Eastern and Western France." Both these ore-fields produce a surplus of ore available for export, but both have been, in different ways, affected by the great war, and the export trade has diminished considerably. This is in no way due to a reduction in their world-value. The eastern iron mines have suffered through the fact that the German ironworks prefer, for political motives, to purchase Swedish ore, even though it is much dearer than French ore; and transport conditions do not favour export to England. British ironworks can, however, continue to import ore from Normandy, Anjou and Brittany, which are unaffected by the transitory conditions which render transport charges from eastern France prohibitive. A paper by M. L. Guillet described the present condition of the metallurgical industries of northern and eastern France. The destruction of the large works in these regions was not due to the war alone, but was carried out by the Germans in a deliberate, systematic and thorough manner both in works along the front, and in those far removed from the battle zone. The reconstructional energy has been admirable and widespread, and, despite financial difficulties arising out of the incomplete peace treaty, the works are gradually resuming their activities. In the course of their reconstruction the works have been modernised, and the future industry has a very promising outlook.

M. Eugène Schneider read a paper on "An Investigation of Hot-drawing on the Mandril," containing a mathematical study of the effect of various factors, together with practical notes on the working conditions during hot-drawing and numerous observations on a large variety of blanks of all dimensions. M. E. L. Dupuy described an investigation into the mechanical properties of steel at high temperatures. The breaking stress and contraction of area were taken as characteristic of the mechanical properties at various temperatures, but the results appeared to show that the mechanism of fracture is not the same at all temperatures; the figures obtained cannot therefore be taken as invariable measures of the same phenomenon. The author describes the types of fracture found in steels in relation to their constitution; of special interest is the observation that, in the β region, fracture is accompanied by practically no deformation. MM. A. M. Portevin and P. Chevenard presented a paper on "Characteristic Curves of the Heat-treatment of Steel." The authors seek to obtain, in a single diagram, a quantitative expression, defining the condition of a steel after heat-treatment in terms of the fundamental factors of all heat-treatment—the temperature of heating and the rate of cooling. Other papers were presented by Mr. N. T. Belaiew on "Damascene Steel," by Mr. K. Honda on "Does the Critical Point depend on the Strength of the Magnetising Field?", by Mr. A. M. Portevin on "Constituents found in Tungsten and Molybdenum Steels," by Messrs. A. M. Portevin and V. Bernard on "A Contribution to the Study of Coalescence," and by Capt. Swabey and Mr. R. Genders on "The Manufacture of Shells in Canada during the War."

After the business meetings groups of members visited iron and steel works in Lorraine, Creusot, and other places.

SOCIETY OF LEATHER TRADES CHEMISTS.

The second bi-annual conference was opened by the president, Dr. J. Gordon Parker, at the Leathersellers' Hall, E.C., on September 7. The proceedings commenced with a reception of the members and associates by the president, who was supported by the Master of the Worshipful Company of Leathersellers and by representatives of the various scientific societies interested in the development of leather chemistry. After hearing various addresses of welcome, the meeting adjourned for luncheon at the Trocadero Restaurant by invitation of the United Tanners' Federation and the Federation of Curriers, Light Leather Tanners and Dressers. The conference was resumed in the afternoon and the following officers were elected:—President: Dr. E. Schell (French Section); treasurer: Prof. D. McCandlish (British Section); hon. general secretary: Dr. A. Gansser (Swiss Section). The accounts for the past two years were adopted, and it was decided to increase the annual subscription by 25 per cent. Barcelona was chosen for the next conference, to be held in 1923.

The two following days were devoted to discussions arising out of the technical agenda, much of which related to the analysis of tanning materials, and it was decided to form an International Commission, with Prof. Procter as chairman, to consist of committees working in the different allied countries under the guidance of various reporters. Mr. G. E. Knowles was appointed reporter for the committee of the British Section. The question of the colour measurement of tannin solutions was next raised, and after discussion the meeting agreed to leave the subject to the commission on tannin analysis which, if it thought fit, could delay action until the publication of Prof. Procter's report on a new system of colour measurement. It was reported that satisfactory progress was being made towards setting up machinery, etc. for the manufacture in this country of a standard hide powder. Tannery chemists are at present dependent on America for their supplies of this material. A resolution was put forward that the commission should attempt to devise a new method of analysis on the lines of the old Filter Bell method, but the resolution was lost by sixteen votes to ten (Associates were not allowed to vote on questions relating to analytical procedure).

Prof. Gordon Parker introduced the subject of leather analysis and stated that although little progress had been made by the British committee, a good deal of work had been carried out by French colleagues. The subject had become very important, and the new Swedish regulations with regard to the adulteration of imported leather emphasised the necessity for adopting standardised methods of analysis. Mr. P. Chambard, addressing the conference in French, described some of his work on leather analysis, and showed by means of a diagram how, after tannage, the quantity of nitrogen (or hide substance) varied in different parts of the same hide. Mr. Chambard was elected chairman of the commission on leather analysis, and Mr. F. O'Brien reporter for the British Section. Mr. W. R. Atkin gave an account of the application of the theory of gelatin swelling to the control of the liming process. He described the behaviour of hide in acids and alkalis (which is almost identical with that of gelatin), and by means of a curve made clear the variation of swelling with alterations of hydrion concentration of the liquors.

PERSONALIA.

Dr. C. Perrier has been appointed director of the chemical laboratory of the Royal Geological Office in Rome.

The chair of physiological chemistry and pharmacy in the University of Basle has been filled by the appointment of Prof. K. Spiro.

Dr. Raymond F. Bacon, having resigned the directorship of the Mellon Institute, will be succeeded in the new year by Dr. E. R. Weidlein.

Dr. Reuben S. Tour has been appointed professor of chemical engineering in the University of Cincinnati, in succession to Prof. O. R. Sweeney, who has resigned owing to ill-health.

The Salters' Institute of Industrial Chemistry has awarded fellowships for post-graduate study in the laboratories indicated to Messrs. J. A. Gentle, B.Sc. (Oxford), F. Raymond Jones, M.C., B.Sc. (Birmingham), S. J. Saint, B.Sc. (Reading), and F. W. Turner, B.Sc. (East London College). Scholarships have been awarded to Messrs. B. G. Banks and L. G. Laws, B.A.

Peter Cooper-Hewitt, the inventor of the mercury-vapour lamp, has died at Neuilly after a long illness.

The death is reported, at the age of 70, of the Norwegian chemist E. W. Dahl, who invented a process of manufacturing white lead which was acquired by an American company in 1898.

The following deaths are announced from the United States:—Dr. W. C. Abbott, a pioneer in the medicinal use of alkaloids; G. H. Ellis, a consulting chemist and author of a work on "White and Tinted Paint Analysis."

The death is announced of Dr. Carl Deite, at the age of eighty-three. The deceased was well-known for his contributions to the technology of the soap industry; he was the first to carry through the industrial purification of glycerin in Germany, founded the *Seifenfabrikant*, and was author of several works on soaps and perfumery.

NEWS AND NOTES.

FRANCE.

Industrial Notes.—*Metallurgy.*—The metallurgical situation remains unchanged, but hopes are entertained of an improvement during the autumn. Faced with keen German competition, French metallurgists have begun to realise that the correct policy to follow is to allow free competition in the home market whilst uniting in order to secure orders for export. It is becoming evident that tariff walls provide no remedy and that commercial treaties ought to be made with the chief foreign countries in order to stop the impending economic war. In purely industrial circles mention is made, both officially and unofficially, of the possibility of a commercial understanding with Germany, according to which Germany would pay in kind for the reconstruction of the devastated areas. As compensation to France for the resulting loss of trade in those regions, sales organisations for the foreign markets would be established, each country supplying a certain quantum of goods in proportion to its productive capacity.

Chemical Industry.—Pending a final decision by the Government as regards the definitive organisation of the Alsatian potash industry, that question is again attracting considerable attention. Most Alsatians are of opinion that the mines should be worked by a single company, and in support of this they contend that the industry must present a united front to the German potash group and, moreover, that such a concentration would lead to a general improvement in technical efficiency. Those who claim that the exploitation of the mines should be entrusted to several companies point out that, however necessary it may be to present a united front to foreign competition, this does not imply the merging of all the mines into a single organisation; all that is needed is an agreement between the different companies regarding conditions of sale abroad. Further, strong doubts are expressed as to the technical advantages to be derived from the suggested concentration as the interests involved are too vast for control by a single undertaking. Such concentration might also lead to a form of State control, for the State might be asked to step in should the price of potash rise, as agricultural interests are in the majority in the Chamber. The situation would be quite different were any danger of a monoply avoided by free competition in the home market. Finally it is held that the great agricultural syndicates, being directly interested in the question, should have a voice in any decision, especially as they could control prices better than the State.

The Union of Chemical Industries has unanimously decided to approach the railway companies with a view to obtaining a reduction in transport rates. Rail rates for chemical products have already been increased by 50 to 130 per cent. over those applied in 1914, and under recent legislation they have been raised by another 140 per cent., plus a tax of 5—10 per cent. The high cost of transport has reacted on consumption and the railways have not only carried less traffic, but have had to face strong competition from water-borne transport. Thus the carriage on pyrites from Rouen to Paris is 17·36 fr. per metric ton by rail against 4·50 fr. by water, and the transport of sulphuric acid from Lille to Paris costs 50 fr. per ton by rail, but only 24 fr. by water. The railway companies will undoubtedly have to give serious consideration to the situation.

Paper Industry.—The French production of paper pulp represents less than one-third of the home consumption and the present high price of paper has stimulated the search for a cheap substitute for the usual wood pulp. Alfa, which grows in abundance in Algeria, is a potential source of cellulosic raw material, but the many attempts to utilise it have been frustrated by heavy freight charges and lack of labour. It has been easier for British manufacturers, as ships calling at Tunisian and Algerian ports for mineral ores and phosphates could complete their cargo with alfa. As previously announced (*cf.* J., 1921, 48 R), a company has been formed in France to use imported alfa as a raw material for paper-making, but as alfa only yields 45 per cent. of pure cellulose, this procedure implies that heavy transport charges would have to be paid on 55 per cent. of waste material. Consequently the Société des Celluloses de l'Afrique du Nord has been established at Algiers with a capital of 2 million fr. to utilise alfa on the spot. Consideration is being given to new processes adapted to local conditions, especially as regards the water, which is not only scanty, but dirty and high in magnesium salts.

The Mining Industry in French Indo-China.—H.M. Acting Consul-General in Saigon reports that although large deposits of iron ore and phosphates are known to exist in Cambodia, alluvial gold in Laos, and zinc, lead, antimony and tin in Tonkin and the Annamese Hills, little exploitation has been done. Coal is raised at Hongai, Dong-triö, and Phamme, all in Tongking. The Hongai mine produces 540,000 tons out of a total annual output of 650,000 t., and the other two are said to yield very good coal, but are comparatively undeveloped; about 350,000 t. is exported, and the coal finds a market even in Japan. Zinc is worked at Cho-Dion and Trang-Du (Tongking); the output was 48,000 t. in 1916, but subsequently decreased. Tin and wolfram occur chiefly near Langson in west Tonkin and at Hinbun on the Annam-Siam frontier; the production in 1918 was 604 tons. Graphite, antimony, lead, and iron are found near Haifong, where a smelting furnace has been in operation since 1919. At Haifong there is also a factory for crushing phosphate rock, of which 7000—8000 t. is mined annually in Annam, Tonkin, and Cambodia. The chief causes of the decline of mining in Indo-China are high wages, working costs, and freights, the state of the metal market, and competition from other countries. Better transport facilities would doubtless lead to a revival of prospecting and exploitation.—(*Bd. of Trade J., June* 23, 1921.)

UNITED STATES.

Heavy Clay Products.—The Bureau of Mines, the Bureau of Standards, and various industrial associations connected with the manufacture of heavy clay products, are actively co-operating with a view to co-ordinated action, and a scheme of research is being drawn up.

Research on Lime.—The factors that influence the hardening of plaster and mortar are being investigated by the National Lime Association. Research is being carried out on the influence of burning, grinding, and hydration of the final product. Various hardening agents are to be tested and it is hoped to discover a material which absorbs carbon dioxide in quantity but liberates it freely upon admixture with lime and water, thereby inducing rapid hardening of the mass.

Exhaust Gases from Motor Vehicles.—An experimental tunnel of the same design as that proposed for the vehicular tunnel which is to connect New York City with the mainland, has been constructed at Brucetown, Pa., for the continuation of research on the ventilation of the new tunnel. The cross-section of the experimental tunnel is sufficiently wide to accommodate a single line of motor-cars, and in studying the problem of the best method for supplying the necessary air the following points will be especially considered:—The diffusion of exhaust gases; the influence of temperature upon the working of motors; and the physiological effects of temperature, exhaust gases, and smoke.

Census of Chemical Manufacturers.—According to a preliminary statement of the 1920 Census of Manufacturers, there are 811 estabishments manufacturing general chemicals, coal-tar chemicals, and sulphuric, nitric and mixed acids, and the value of their output is over $600,000,000 annually.

Research Endowments.—The National Research Council has compiled a list, at present incomplete, of the medals, prizes, scholarships, and fellowships available for the encouragement and support of scientific research in the United States. It appears that from 40 to 50 million dollars is spent annually in this manner, and if the community trust funds, which have been founded in several cities, be included, the income from approximately 500 million dollars (£125,000,000) is now available for research in the natural sciences.

Commerce Reports.—It is announced that after September 5, *Commerce Reports*, published by the United States Bureau of Foreign and Domestic Commerce will be issued each week, instead of daily as heretofore. Considerable changes are planned and special divisions are being organised to deal with groups of commodities such as textiles, fuel, chemicals, iron and steel, foodstuffs, rubber, leather, etc. Experts placed in charge of each division will contribute specific trade information to *Commerce Reports*, which will become a weekly trade paper scientifically prepared and classified on a commodity and geographical basis. The annual subscription is $3 and the paper can be obtained from the Superintendent of Documents, Washington, D.C.

AUSTRALIA.

The Zinc Industry.—The Broken Hill Proprietary Co. has decided to resume the production of zinc concentrates, and accordingly operations at the flotation plants and the sulphuric-acid works will be restarted.

A *Reuter* message of September 19 states that the Electrolytic Zinc Co. has purchased from the British Board of Trade 750,000 tons of zinc concentrates and slimes.

Groundnut Cultivation in Queensland.—At present Australia imports annually about 2000 tons of groundnuts and 250,000 galls. of groundnut oil, but the growing importance of the product has led to the search for areas suited to this crop in Australia. Such an area is stated to exist in the Cooktown district of Queensland, where the volcanic soil is rich and deep and the climate favourable. As experiments made in this district have shown that groundnuts can be produced with an oil content of 51 per cent., operations on a larger scale have been planned. The large Chinese and red Spanish varieties are to be grown; the first-grade nuts will be used for edible purposes and the lower grades will be crushed for oil.—(*Ch. of Comm. J., July* 15, 1921.)

NEW ZEALAND.

Paper-Making Materials in New Zealand.—Large quantities of sawdust and other wood waste are produced by the New Zealand timber industry and samples of eight timbers have been examined at the Imperial Institute in order to ascertain whether they could be utilised as paper-making materials. It was found that four species of *Fagus* (*Solandri, cliffortioides, Menziesii, fusca*) yielded from 41·5 to 44·0 per cent. of pulp which bleached readily and furnished fairly strong papers of good quality. *Beilschmiedia Tawa* yielded 42·5, and *Weinmannia racemosa* 36·5 per cent. of pulp that bleached satisfactorily and had good felting properties. The strongest papers were obtained from the wood of *Pinus Laricio* and *P. radiata*, but the pulps did not bleach so readily, the yields were only moderate (39 per cent.), and more caustic soda was required, owing to the presence of numerous knots. All these timbers would be suitable for the manufacture of paper pulp in New Zealand if available in sufficient quantity, but various economic factors would have to be carefully considered before the industry was established on a commercial scale.—(*Bull. Imp. Inst.*, XIX. No. 1, 1921.)

BRITISH INDIA.

Forecast of the Sugar-Cane Crop.—The total area planted to sugar-cane is estimated at 2,371,000 acres as against 2,636,000 acres at the corresponding date last year, or a decrease of 10 per cent. Of the total area under sugar cane in British India the United Provinces contain 52·7 per cent., Punjab 16·9, Bihar and Orissa 10·3, Bengal 8·4, Madras 4·2, Bombay and Sind 3, Assam 1·3, and the North-West Frontier Province 1·2 per cent. Weather conditions at sowing time were not generally favourable except in Madras, but the present condition of the crop is fair on the whole.—(*Ind., Tr. J., Aug.* 25, 1921.)

CANADA.

Water-Power Resources.—The Dominion Water Power Branch has been engaged for the past two years in preparing revised estimates of the water-power available in Canada. From data recently published it appears that the available 24-hr. power at 80 per cent. efficiency is 18,255,316 h.-p. at ordinary minimum flow and 32,075,998 h.-p. at the estimated flow for maximum development, *i.e.*, that which can be depended on for six months of the year. The machines already installed, however, give 30 per cent. more power than that calculated from the six-month maximum flow, so that the recorded water-power resources of the Dominion would permit of a turbine installation of 41,700,000 h.-p. At present the power actually harnessed is 2,470,580 h.-p., or 5·9 per cent. of the total available resources. The water-power now developed represents an investment of $475,000,000 and an annual equivalent of 18,500,000 t. of coal worth, at $8 per ton, $148,000,000. Should the rate of increase during the past 15 years be maintained, by 1940 the total investment will have become over $1,000,000,000, and the power developed equivalent to 42 million t. of coal worth $336,000,000.—(*Bd. of Trade J., Aug.* 18, 1921.)

GENERAL.

Research on Motor Fuels.—A joint research committee has been formed by the National Benzol Association and the University of Leeds for the purpose of carrying out research into the production and use of benzene and its homologues. The whole of the carbonisation industries of the country, including primarily by-product coke-oven plants and gasworks, is interested in the objects of the Association which has, therefore, a wide and influential membership. The variety of carbonisation and gasification processes now used, taken in conjunction with the increasing demand for light oil in the United States and other petroleum-producing countries and the consequent limitation of their capacity for export, make it very necessary for this country to place itself in as strong a position as possible with regard to the home production of light oil and motor spirit. It is believed that one of the best ways of so doing will be to utilise the by-products obtainable from coal to the fullest advantage. To do this adequately requires investigation on a more extended scale, and the commercial enterprises concerned have plenty of work of this kind before them. Many important problems, however, which concern the industry as a whole can be best attacked by joint action. In this case not only members of the Association drawn directly from the industry but members of the staff of Leeds University occupied with cognate matters are to co-operate. The new committee will be constituted in a similar manner to the Joint Research Committee on the Gas Industry, with equal representation from the University and the Association. Work will be carried out under the direction of the committee and the supervision of Prof. Cobb on important or urgent problems, and reports embodying the results will be published at intervals. The initial membership of the joint committee is as follows:—Prof. J. W. Cobb, Prof. J. B. Cohen, Prof. A. G. Perkin, Prof. Granville Poole, Prof. A. Smithells, W. G. Adam, Dr. T. Howard Butler, S. Henshaw, S. A. Sadler, and Dr. E. W. Smith.

The Proposed Testing Station for Medicinal Products in Germany.—The proposal to establish a testing station for medicinal products has been abandoned, as only 30,000 mk. was raised for the purpose; an export bureau for medicinal products will probably be founded instead.—(*Chem.-Z., Aug.* 11, 1921.)

German Patent Fees.—As from July 15, the following fees are payable for patents in Germany:—Application 100 mk.; fees for the first two years 100 mk. each year; the fees then increase by 50 mk. each year for the next four years, by 100 mk. each year for the succeeding four years and by 150 mk. each year for the last four years. An appeal on rejection costs 100 mk., a petition for revocation of the patent 300 mk., and an appeal thereon 500 mk. An application for registration of a trade mark costs 200 mk., or for a "Verbandszeichen" 1000 mk., and a renewal of a trade mark 300 mk. —(*Chem.-Z., Aug.* 11, 1921.)

The German Potash Industry.—The only potash-producing area now under German control is that of Central Germany, where conditions of production are very favourable, and 86 per cent. of the potash lies at a depth of some 1200 metres and a further 10 per cent. at 1500 metres; deposits at a depth greater than 1700 metres are no longer worked in Germany. In 1920, with an output of 11,390,000 metric tons of potash, the pre-war level was almost attained, viz., 11,607,510 t. in 1913. Sales, however, have declined from 5,180,000 t. in 1913 to 4,310,000 t. in 1920, and exports, which constituted roughly half the sales before the war, were only 330,000 t. crude salts (12—15 per cent. K_2O) and 490,000 t. manure salts (38 per cent. K_2O) in 1920. Some improvement has taken place in the agricultural consumption of potash, which from 540,000 t. potash (K_2O) in 1913 has become 830,000 t. in 1917, and 610,000 t. in 1919, whilst Holland and Czechoslovakia have become important consumers. But although the extent to which the English, Belgian, French, Russian, Austrian, and other markets are lost cannot yet be ascertained, it is certain that the acquisition of Alsace by France has broken the German world monopoly of potash. The increase in the exports of potash (K_2O) from Alsace between 1913 and 1920 is shown in the appended table:—

	1913.	1919.	1920.
		Metric tons.	
France	10,278	48,958	86,578
Germany	13,743	13,743	13,743
United States	12,185	26,702	55,967
Great Britain	219	4,499	17,890
Belgium	614	4,414	19,750
Other countries	3,682	9,157	18,990
Total	40,721	93,730	199,175

Faced with these new conditions, the German industry is establishing new connexions and outlets, and although the American market is overstocked and protective tariffs have closed the French and Spanish markets, the Polish and Swedish markets still remain, and the Swiss import duties have recently been reduced.

Industrial Notes from Belgium.—A large plant is being erected at Ghent for the Belgian company, La Floridienne, which manufactures phosphatic fertilisers from phosphate extracted from its own mines in Florida and Tunis.—(*U.S. Com. Rep., June* 8, 1921.)

The Artificial Silk Industry.—At the request of the Belgian manufacturers of artificial silk, the Belgian Government has reduced the price of alcohol from 1·50 to 1·18 fr. per litre. The result of this will be to diminish the cost of production of artificial silk by 3·50 fr. per kg., as alcohol is one of the chief raw materials used in the industry.—(*Chem. Ind., July* 18, 1921.)

Costs in the Belgian Plate-glass Industry.—It is estimated that production costs in the Belgian plate-glass industry have now reached 600 per cent. of the pre-war figures. This advance is due not only to the increased cost of raw materials and wages (roughly 400 per cent.), but also to the introduction of the 8-hr. day, which has necessitated the use of three shifts per day instead of two. To the total production cost, labour contributes 16 per cent., coal 21, raw materials 47, and maintenance 10 per cent.; sales, agencies, warehousing, etc. are estimated to cost 4 fr. per sq. metre. Wages vary from 23 to 31 fr. per 8-hr. day, according to the nature of the employment. The coal now obtainable is decidedly inferior to that sold prior to the war.—(*U.S. Com. Rep., July* 8, 1921.)

The Vegetable-Oil Industry.—This industry is now producing at less than 50 per cent. of the pre-war rate. There are about 100 oilseed-crushing factories, none of which employs more than 300 men, and over one-half of the plants produces linseed oil, which is largely consumed by the domestic soap and paint industries. Imports of oil-bearing materials have declined, and the home consumption of oils and oilcake has greatly diminished. Belgium produces no oilseeds except about 3000 metric tons of linseed per annum, and the import of linseed has fallen from 260,000 t. in 1913 to only 21,000 t. in 1920. The decrease in the imports of palm oil from 7000 t. in 1913 to 3000 t. in 1920 marks the development of the palm-oil industry in the Belgian Congo. The margarine industry, however, has more than doubled its production, which is now estimated at 30,000 t. per annum.—(*U.S. Com. Rep., July* 20, 1921.)

The Spanish Mineral Industry.—The following statistics of the Spanish production of ores, minerals, metals, chemicals, etc., are supplementary to those previously given in these columns (*cf.* J., 1921, 132 R):—

	Metric tons.
Crude ores, etc.:—	
Asphalt	4,504
Barium sulphate	11,459
Bismuth	75
Graphite	1,958
Soapstone	3,024
Sodium chloride	37,801
Sodium sulphate	3,230
Sulphur	89,586
Wolfram	337
Chemicals, refined products, etc.:—	
Acids:—	
Hydrochloric	1,081
Nitric	270
Sulphuric	73,379
Ammonium sulphate	4,280
Benzol	2,166
Bitumen, artificial	2,327
Calcium carbide	17,769
Copper sulphate	7,988
Lead, white	2,228
Mineral colours	5,349
Tar	15,249

The production of ore in the province of Vizcaya in 1920 amounted to 2,678,000 metric tons; 409,154 t. of ore was smelted in the country and 2,359,295 t. exported. Of the 2,033,295 t. shipped from Bilbao, over 91 per cent. was destined for the United Kingdom.—(*U.S. Com. Rep., Apr.* 15, 28, 1921.)

The Spanish Sugar Industry.—During 1920 the output of raw beet sugar in Spain was 238,818 tons. As the normal consumption of sugar is 140,000 t., a large quantity will be available for export. The output of raw sugar during recent years has been:—1913–14, 166,300 tons; 1914–15, 100,000 t.; 1915–16, 104,500 t.; 1916–17, 124,100 t.; 1917–18, 135,000 t.; 1918–19, 139,400 t.; 1919–20; 81,650 t. It is stated that the capital invested in the Spanish beet-sugar industry amounts to 300 millions pesetas (peseta=9½d. at par, now about 8·4d.).—(*Ind. Tr. J., Aug.* 18, 1921.)

The Argentine Sugar Crop in 1921.—If there is no heavy frost the Argentine sugar crop for 1921 will, it is estimated, amount to 220,000 metric tons, an amount which will meet the requirements of the Republic. Of the total crop, 180,000 t. will probably be produced by the Tucuman mills, and the remainder from those of Salta, Jujuy and Chaco.—(*U.S. Com. Rep., July* 28, 1921.)

Alcohol Production in Buenos Aires.—Twenty-nine distilleries are now producing industrial alcohol in Buenos Aires. In 1918, 7,396,760 galls. (U.S.) was made from molasses and 1,056,680 galls. from grains, principally maize. Wine alcohol is made by 360 distilleries which have a combined annual output of approximately 792,510 galls. of proof spirit. Denaturation is effected by adding wood alcohol obtained by distilling chips of paving blocks made of algarrobo wood. The present output of wood alcohol is insufficient and steps are being taken to increase it.—(*U.S. Com. Rep., June* 16, 1921.)

The Glass Industry in Argentina.—During recent years the Argentine glass industry has expanded greatly and the total annual production is now at least 70,000 tons. There are three companies with capacities varying from 10,000 to 25,000 t., and 10 factories each with a capacity of about 5000 t. At present local requirements cannot be met, but the situation should be relieved when new plant is installed, especially as a small company in Buenos Aires is now producing glass-making machinery. Many of the essential raw materials are present in the country, but chemicals such as arsenic, lead, colours, soda, and the greater part of the sand are imported. There are large deposits of sand and limestone of a suitable nature, however, and sodium sulphate can be procured both from natural deposits and from two sulphuric acid factories. Sodium carbonate, litharge and minium are not produced, but deposits of sodium chloride and of lead ore are being worked and may later supply the glass industry. Manganese dioxide is mined at Santiago del Estero, etc., and although 2 tons per day is being used by the industry, a good market still exists for imported manganese. The refractory earths used are obtained mainly from England, but local materials are being tested, although without success as yet. The market for metallic oxides and fine chemicals not produced in the country is very limited, as little coloured or fancy glass is made. As a rule the equipment of the factories is simple, no cooling or regenerative systems being employed, and the production is mostly limited to cheaper articles.—(*U.S. Com. Rep., June* 18, 1921.)

Resources of the Karelian Isthmus, Finland.—The Karelian Isthmus, eastern Finland, is said to possess much natural wealth. Sufficient power to supply the whole district could be obtained from the Kiviniemi waterfall (not far distant from Viborg and Petrograd), which if harnessed could develop 25,000 h.p. Fuel peat could be obtained from local bogs; about 62 acres of the extensive Petogoki peat bog, near Kiviniemi, is estimated to contain the equivalent of about 100,000 tons of air-dried peat. Quartz sand containing very little iron occurs at Kiviniemi and is said to be suitable for the manufacture of domestic glassware. Cambrian clay is also found at Kiviniemi in sufficient quantity and of adequate quality to supply all the firebricks and earthenware required in the country for a lengthy period; in 1920, imports of earthenware and similar products were valued at 40 million marks (Finnish mark=11¾d. at par, now 0·1d.). The deposits of phosphorite found in the surface layers of the Cambrian clay have aroused great interest as at present phosphatic fertilisers have to be imported; samples contained 14·7—29·9 per cent. P_2O_5, but the extent and value of the deposits are not yet determined.—(*U.S. Com. Rep., June* 16, 1921.)

REPORTS.

REPORT ON THE TRADE, INDUSTRY, AND FINANCE OF MOROCCO, DATED MAY, 1921. FRENCH ZONE, *By* G. H. SELOUS, *H.M. Vice-Consul, Saffi;* TANGIER ZONE, *by Vice-Consuls* JOHNSTON *and* HOBSON; SPANISH ZONE, *by* C. R. B. ATKINSON, *H.M. Vice-Consul, Tetuan. Department of Overseas Trade. Pp.* 67. *London: H.M. Stationery Office.* 1921. *Price* 2*s. net.*

The industrial development of the French Zone of Morocco, although still in its initial stages, continued to make steady progress in 1920 and several new undertakings were established, such as a new flour mill, a cement works at Petitjean, electric power-stations, a brewery at Casablanca, and the manufacture of soap by the chief olive-oil mill at Marrakesh. Further developments have taken place in the flax industry, as a company has been formed with a capital of 8 million fr. for the production and purchase of flax. Sugar beet has been shown to give a yield nearly equal to that obtained in France (12 tons per acre), but as the beet cannot be stored it can only be used for distilling. Promising results have also been obtained with cotton and vines.

The phosphate deposits have been declared a State monopoly, and a contract has been made with a private firm for the production of 20,000 tons of superphosphate per annum when the important phosphate deposits in the Oued Zem—El Boroudj district, S.E. of Casablanca, are opened up. Two very important phosphate deposits have also been discovered and it seems likely that Morocco will eventually rank with Florida and Tunis as one of the chief phosphate-producing countries. Numerous permits have been issued for prospecting for oil in the area stretching from the N.W. of Gibel Tselfats to Fez and Taza, and two permits for exploitation have been issued. So far, phosphates are the only mineral shown to be of commercial importance in Morocco, but oil offers hopeful prospects.

The year was a bad one for trade owing to the poor harvest and general economic conditions. The United Kingdom, however, maintained its second place in the import trade with 26 per cent., as compared with France's 57 per cent., out of total imports valued at £20,000,000. France took 52, the United Kingdom 29, and Spain 3 per cent. of exports valued at slightly over £5,000,000. The trade of the Tangier Zone was very poor in 1920, imports increased by over 50 per cent. to 95,254,121 fr. and exports decreased to 6,115,290 fr. The market was overstocked with many commodities and trade was hindered by the fluctuating value of the franc. Cotton goods and candles are the chief products obtained from Great Britain and there would have been a large demand for British cement, which is preferred to the French or Spanish material, but for the heavy freight charges. France and Algeria supplied 34, Spain 25, and the United Kingdom 18 per cent. of the imports, and Spain took 52 per cent. of the exports, followed by France and Algeria with 18, and the United Kingdom with 17 per cent. The only important event recorded during the year was the discovery, in the neighbourhood of Tangier, of a deposit of bituminous schist and the formation of an Anglo-French company to work it.

Many new permits were issued for prospecting in the Spanish Zone where British mining interests are represented by the Morocco Minerals Syndicate, Ltd., which has lately admitted Spanish co-operation to the extent of 60 per cent. During the first six months of 1920 the mineral output included 208,000 t. of lead (galena) and iron ore. Exports were valued at 8,974,132 pesetas (peseta=9½d. at par, now 8·4d.), and imports were worth 35,316,249 pesetas, of which Spain supplied 73 and the United Kingdom 11 per cent. The chief imports from the United Kingdom are foodstuffs, textiles, perfumery, soap, candles, varnishes, ochres, ultramarine, glassware, and matches. British goods are popular, but competition from Germany and Belgium in glassware, Belgium in iron beams, and Spain in textiles and cement has to be faced (*cf.* J., 1921, 34 R).

REPORT ON THE ECONOMIC AND INDUSTRIAL CONDITIONS OF THE SERB-CROAT-SLOVENE KINGDOM, DATED APRIL, 1921. *By* CAPT. E. M. HARVEY, *Commercial Secretary to H.M. Legation, Belgrade. Department of Overseas Trade. Pp.* 36. *London: H.M. Stationery Office.* 1921. *Price* 1s.

The Kingdom of the Serbs, Croats and Slovenes, or Yugoslavia, consists of Serbia, Serbian Macedonia, Montenegro, the former Austro-Hungarian territories of Croatia, Slovenia, Slavonia, Dalmatia, Bosnia, Herzegovina, and Vojvodina in western Banat, its total area is slightly greater than that of Great Britain, and its population is about 14 millions. The country has great natural riches, which are, however, but little developed, and the industries are mainly based upon agriculture. Forests cover a very large area; timber is an important export, and tanning materials are very plentiful. Wood distillation is carried on at one or two factories in Bosnia and paper is made in small quantities. Milling is the most highly-developed industry, but the sugar factories have an annual capacity of about 60,000 tons, although in 1920 only about 18,000 t. was produced. Until recently there were about 70 factories distilling alcohol from grain, and the estimated yearly output of spirit is 3,960,000 gallons. Flax, hemp and silk are important industries and there is a very large factory at Veliki Becherek producing vegetable oils. Hides are produced in large numbers, and the tanneries have a capacity of 10,000 metric tons of sole leather and 3250 t. of other leather per annum. The leather industry is making rapid progress.

Mining is very little developed. Iron ore occurs at Ljubuski and Vares (Bosnia). There are large deposits of lignite, but practically no coking coal, 3,223,733 t. of lignite and brown coal being produced in 1920. Copper is produced at Bor, where the pre-war output was 7000 t. of blister copper; a little alluvial gold is obtained in the Timok (N.E. Serbia), and silver occurs as argentiferous lead ores. The State lead mines at Postenje, which were abandoned in 1907, are now under British control. Serbia, Bosnia, and Northern Slovenia contain important deposits of lead and zinc ores; chrome ore is found in Northern Slovenia, Bosnia and Serbia; and low-grade manganese ore in Bosnia. (For the bauxite deposits in Dalmatia *cf.* J., 1921, 97 R.) **Petroleum** is being sought for in the Belovar, Virovitica and Darovar districts of Croatia, but so far only natural gas has been observed. The metallurgical industry is small, pig iron and small castings being the main products, and many of the factories have not recovered from the effects of the war. A good future is predicted for the glass industry, as suitable raw materials are found in the country.

Industrial reconstruction in Yugoslavia is being hindered by lack of capital and labour, depreciated exchange, and deficient transport. In 1920 the adverse trade balance improved slightly, but it is still considerable. Imports were valued at 3488 million dinars (dinar=9½d. at par, now about 1¼d.) and exports at 1320·9 millions. The imports, mainly manufactured products, included (in millions of dinars):—Chemicals, pharmaceutical products, colours, ether, alcohol, perfumes, explosives, 225; rubber and gutta percha, 12·8; glass, etc., 34·3; metals and products thereof, 363·4; animal and vegetable fats, etc., 83·5. Among the exports were wood and wood products, 323, tanning materials, 34·3, and minerals 11·4 million dinars. Austria took 42·67 per cent. of the export trade, Italy 26·97, Germany 7·52, and Great Britain 0·25 per cent. The importation of British goods in 1920 was hindered by the fluctuating exchange, delays in transit, and competition from countries like Austria, Czechoslovakia, and Italy, where currency was much depreciated.

REPORT TO THE BOARD OF TRADE OF THE DEPARTMENTAL COMMITTEE ON GAS INCOMBUSTIBLES. *Pp.* 12. *London: H.M. Stationery Office.* 1921. [*Cmd.* 1492.] *Price* 1*d.*

The present Report embodies the recommendations of a Departmental Committee appointed under the provisions of the Gas Regulation Act, 1920, to inquire into the necessity or desirability of prescribing any limitations of the proportions of incombustible constituents which may be supplied in town's gas. Under the provisions of the Gas Regulation Act, 1920, the question resolves itself into an inquiry as to whether gas of any specified calorific value is reduced in its value to the consumer by the incombustibles which it may contain. Incombustibles normally present in town's gas are carbon dioxide, nitrogen and oxygen, but the last of these is not strictly an inert gas. Evidence was given before the Committee by the Sheffield Gas Consumers' Association, the railway companies, the London County Council, the National Gas Council, the Gas Companies' Protection Association, and others. It is pointed out that future developments may conceivably render available to the gas industry a gas of high calorific value requiring, to facilitate its distribution and use, considerable dilution with low-grade fuel gases containing a high proportion of incombustibles. Alternatively, gases of low calorific value having a high content of incombustibles may become available from processes involving internal heating of the retorts. It is undesirable in the interests of the consumer that gas undertakings should, by legal enactments, be prevented from availing themselves of such supplies. The suggestion that the percentage of incombustibles present should be restricted by placing a limitation upon the specific gravity, or the variation in specific gravity, of the gas was not favourably entertained by the Committee. The evidence submitted appears to indicate that the harmful effect of carbon dioxide for certain uses is considerably greater than that of nitrogen. On the basis of the evidence submitted, the Committee recommends that at present no limitation be placed on the proportion of incombustible constituents in town's gas, and that after a period of three years a further inquiry into the question be instituted.

COMPANY NEWS.

CALICO PRINTERS' ASSOCIATION, LTD.

At the twenty-second ordinary general meeting, held in Manchester on September 21, Mr. Lennox B. Lee, chairman, criticised adversely the Dyestuffs and the Safeguarding of Industries Acts. The Government, he said, had set itself to champion the interests of a few firms without regard for the interests of the nation as a whole. These Acts placed certain industries in a privileged position, but the interests of agriculture, coal production, the cotton and woollen industries, and calico printing had not been safeguarded in any way; in fact, the last-named industry had been specifically penalised by the imposition of a tariff on imported dyes. Attempts had been made to show that the cost of dyes was of relatively small importance to users. That might apply when the cost of the fabric was very high compared with that of the dye, but the dyeing of such fabrics constituted less than 10 per cent. of the total trade of the Association. Most of its trade consisted in commission printing on customers' own cloth, worth about 4d. per yard, and a saving of 0.144d. per yard represented a profit of 18 per cent. on the ordinary shares, and a saving of 2.49d. a profit of about 300 per cent. Not only were cheap materials essential to success, but they must be the very best that the world could supply. The provision in the Dyestuffs Act that a firm could import a particular colour only by proving that the home price was a prohibitive one from the standpoint of competition was impracticable; it was impossible to demonstrate that at any given moment the increased price of one of the many items constituting total production cost was by itself responsible for loss of trade.

The argument that national safety depended upon the establishment of a dye-making industry was met by the statement that our capacity to produce poison gas and high explosives depended not upon dye-maing in particular, but upon our chemical industries in general, and these were already in a very strong position. The Board of Trade returns for 1920 showed that from the point of view of producing war materials our chemical industries needed no artificial aid. If it were contended that we must shut out foreign dyes in peacetime in order to ensure a home supply for our textile industry in time of war, the answer was that dyes were only one of the many essentials of our textile industries; a supply of raw cotton was even more essential, but no one had proposed to try to grow cotton in the United Kingdom! It was ridiculous to pretend that either our national or industrial safety in wartime depended upon home-made dyes, magnetos, etc. Our only security in time of war was our Navy to prevent the interruption of our overseas commerce, and our only means of paying for the food which we must import was by selling abroad the produce of our factories; to sell that produce we must be able to purchase our raw materials at the lowest prices offered in the world markets, and its quality must excel that of competing foreign wares; any loss of trade in our export markets would be followed by a loss in the home market.

The Association had incurred losses owing to the great and rapid fall in the value of its stocks, but the loss would be diminished by refunds of excess profits duty. The works were not fully employed, money was still being lost, and there was no hope of covering expenses until trade revived; prosperity would not return until excessive Government control ceased to destroy wealth by hampering enterprise and encouraging idleness.

OFFICIAL TRADE INTELLIGENCE.

(From the Board of Trade Journal for September 15 *and* 22.)

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W. 1, from firms, agents, or individuals who desire to represent U.K. manufacturers or exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department and quoting the specific reference number.

Locality of firm or agent.	Materials.	Reference number.
Australia ..	Pottery	219
" ..	Heavy chemicals, paper	245
Canada.. ..	Druggists' raw materials	222
"	Heavy chemicals, leather	246
"	Pottery	248
"	Pulp- and paper-making machinery..	249
"	Druggists' glassware, bottles ..	*
New Zealand ..	Leather	253
France	Paint, varnish, colours	255
Greece	Sugar, oils	257
Italy	Boot upper leather	226
Norway ..	Colours, varnish, lubricants	260
Switzerland ..	Chinaware	228
" ..	Drugs	262
China	Paint	230
United States ..	Industrial chemicals, oils, grease, wax	232
" ..	Iron and steel bars, plates and sheets, galvanised sheets, wire, tinplate ..	235
" ..	Barytes, Paris white, zinc oxide, lithopone, ochre, umber, sienna, Venetian red, red oxides of iron, earth colours, creosote oil	237
" .. " .. "	Lithopone, zinc oxide, cresylic acid, tartar, sodium sulphide, gum arabic, beeswax, magnesium chloride, blanc fixe, sodium cyanide, sal ammoniac, bromides, naphthalene, fuller's earth	240
" ..	Heavy chemicals, laboratory supplies	241
" ..	Chinaware	242
" ..	Steel rails, wire	265
" ..	Steel plates, sheets and rails ..	266
" ..	Caustic soda, soda ash, barbed wire..	271
" ..	Laboratory supplies	277
Brazil	Cement	278
Chile	Drugs, earthenware	279

* The High Commissioner for Canada, 19, Victoria Street, London, S.W. 1.

TARIFF, CUSTOMS, EXCISE.

British India.—As from August 11 the cess of one rupee per maund on indigo paste produced in India and exported therefrom is to be levied on one-third of the total weight of such paste exported.

Canada.—A drawback of 99 per cent. of the import duty is allowed, under certain conditions, on certain steel bars and sheets used for specified purposes.

Egypt.—The export of chemicals and drugs (except fertilisers) is allowed without special licence as from August 29.

The Customs duty on perfumery is fixed at 170 millièmes per litre or 10 per cent. *ad valorem*, whichever is the greater.

France.—The export of mineral oil is permitted as from September 6.

Italy.—Export licences are no longer required for antimoniferous lead scrap, medicinal castor oil, lime residues from gasworks, lubricants made from non-edible vegetable oils, certain cereal wastes, cattle cakes, etc.

The manufacturing taxes on spirits, acetic acid, and beer have been increased as from September 14.

Kenya.—The increased customs duties on cement, chemicals, mineral oils, paint, soap, turpentine, etc. came into force on August 10.

Lithuania.—A copy of the tariff of export duties may be seen at the Department. It is proposed to fix the customs duties on a new basis.

Mexico.—Increased import duties are payable on alcoholic beverages and perfumery.

Newfoundland.—The Customs Tariff Amendment Act came into force on May 26. A special additional war surtax of 25 per cent. is levied on all dutiable goods with a few exceptions. The rates of duty have been modified on sole leather, kerosene, and sugar. A sales tax of 5 per cent. *ad valorem* on imports has been levied as from June 13 on many goods.

Poland.—Customs duties will be levied as from September 7 on condensed milk, fertilisers, train oil, margarine, graphite, antimony, ammonium nitrate and sulphate, Glauber's salt, mineral acids, dye-earths, certain metals, cellulose, and certain kinds of printing paper.

Among the articles on which the duties may be paid in paper at 10 times the nominal rates are olein, vegetable wax, leather for the textile industry, asbestos, certain wares of glass, porcelain and rubber, sulphate and hydrosulphite of soda, nitrates of thorium, cerium, beryllium, aluminium and magnesium, napthols and sulpho-derivatives, hydrosulphite of lime, ether, tanning extracts, and certain metals.

The export of green hides and skins and oilseeds is prohibited as from September 7.

Portugal.—All minerals except tin and tin ore may now be exported without payment of surtax. Kaolin, however, is subject to an export surtax of 7 escudos per metric ton, but if exported in Portuguese vessels the rate is reduced to 3 escudos.

Goods from or originating in Norway are subject to 5 times the normal customs duties and import surtaxes as from September 6.

Rumania.—The export of rape seed is prohibited as from August 19. Modifications have been made in the export taxes on timber and the commission charges on petroleum products.

Togoland.—As from July 20 the customs duties are to be the same as those levied in the Gold Coast Colony.

Tunis.—The export duty on oilcake and the prohibtion of the export of raw cattle bones have been withdrawn.

GOVERNMENT ORDERS AND NOTICES.

Export Credits Scheme.—Italy and Portugal, including Portuguese Colonies, have been added to the list of countries included in the Export Credits Scheme.

Manufacture of Lead Compounds.—Regulations, dated August 23, 1921, have been made by the Home Secretary under the Factory and Workshop Act, 1901, dealing with the manufacture of carbonate, sulphate, nitrate, and acetate of lead.

Prohibited Exports.—An open general licence has been issued permitting, as from September 15, the export to the Channel Islands of basic slag, superphosphate of lime, and compound fertilisers containing either basic slag or superphosphate of lime.

Power Methylated Spirits.—The Commissioners of Customs and Excise have issued regulations entitled the Power Methylated Spirits Regulations, 1921, dated August 18, regulating the manufacture, storage, removal, sale, use, and supply of power methylated spirits, and the importation, removal, storage and use of spirits to be used in their manufacture.

Safeguarding of Industries Act.—The President of the Board of Trade has appointed a permanent panel from which committees consisting of five persons will be selected from time to time to report upon complaints referred to them under Part II. of the Act (Prevention of Dumping). Among the 33 members of the panel is Mr. R. G. Perry, hon. vice-president of the Association of British Chemical Manufacturers.

The Board of Trade has issued lists defining the articles which fall under the general descriptions set out in the Schedule to the Safeguarding of Industries Act (*cf.* J., 1921, 131 R). The lists can be obtained from H.M. Stationery Office, price 9d. Duty is chargeable upon all the articles included in the lists on and after October 1, 1921.

TRADE NOTES.

FOREIGN

Trade of Italy in 1920.—Italian trade in 1920 showed a distinct improvement, as imports declined by 761 million lire to 15,862 million lire and exports increased by 1738 lire to 7803 million lire (lira = 9½d. at par, now about 2·9d.). Although the imports of raw materials decreased, the values of imported semi-manufactures and manufactures were higher, indicating that, despite an elaborate industrial programme, Italy has been unable to curtail purchases of manufactured products. The United States took the largest share of the import trade with 31 per cent. (as against 44 per cent. in 1918) followed by the United Kingdom with 15, Argentina, with 10, and France with 8 per cent. A feature of the import trade was the decrease in imports from the United States, the bulk of this trade going to Germany, Czechoslovakia, and Austria. The United States was the chief source of mineral oils, sugar, glucose, iron and steel manufactures, and paraffin wax, whereas the United Kingdom supplied the greater part of the coal, potash and caustic soda, rubber manufactures, fats, paints and varnishes, hides and skins, France supplied most of the tanned leather and iron bars, but Germany furnished most of the colours, chemicals and medicinal products (followed closely by France as regards the two last-named items). France took the largest share of Italian exports with 14 per cent., followed by Switzerland with 11·5 and the United Kingdom with 11·3 per cent. Italian exports to the United Kingdom consisted chiefly of calcium citrate, crude tartar, hemp and manufactures thereof, pneumatic tyres, etc.—(*Bull. Dept. Tr. Com., Can., June* 13, 1921.)

The Camphor Market in Japan.—Owing to the economic depression the Japanese celluloid industry has become stagnant and there is no demand for camphor. The Monopoly Bureau has therefore reduced the price of camphor from 270 in Feb., 1920, to 235—240 yen at the present time (yen = 2s. 0½d.). Japanese camphor is being dumped on the American market.—(*Ch. of Comm. J., Aug.* 12, 1921.)

The Chinese Dye Trade.—During 1920 Chinese imports of coal-tar dyes, other than indigo, from Germany greatly increased. From a value of 24,250 haikwan taels (haikwan tael = about 3s. 9d.) in January, 1920, the import of German coal-tar dyes rose to 417,116 t. in June and amounted to 2,168,377 taels out of a total import worth 5,219,923 taels for the whole year. In the first two months of 1921 Germany supplied China with dyes worth 529,250 taels out of a total valued at 857,032 taels.

The import from Great Britain in January and June, 1920, was worth 12,005 and 12,776 taels, respectively. China is now the largest consumer of indigoid dyes in the world, but the consumption of synthetic indigo has decreased very greatly, as the natural product has become much cheaper. After indigo, the most important dyestuff used in China is Sulphur Black, which until recently was almost exclusively supplied by Japan.—(*Chem. Ind., Aug.* 8, 1921; *U.S. Com. Rep., July* 26, 1921.)

Cinchona Trade of the Dutch East Indies.—The export of cinchona bark from the Dutch East Indies in 1920 was 4526 metric tons, directed chiefly to Great Britain and Holland. Exports of quinine amounted to 418·9 t., of which Egypt took 124·6 t., Great Britain 102·5 t., and India 54·9 t. Compared with 1919 the export of quinine decreased by 221·4 t.; this was due, not to any shortage, but to the policy of holding back supplies in order to keep up prices.—(*Chem. Ind., July* 25, 1921.)

REVIEWS.

THE CHEMICAL EFFECTS OF ALPHA PARTICLES AND ELECTRONS. *By* S. C. LIND. *American Chemical Society Monograph Series. Pp.* 182. (*New York: The Chemical Catalog Company, inc.* 1921.) *Price* $3 *net.*

The investigation of radiochemical effects has occupied a number of workers, and although the interpretation of the results is often attended by quite peculiar difficulties, several important generalisations have been reached. The term "radiochemistry" may be taken to comprise all relations between chemical and radiant energy, the latter being understood to include not only electromagnetic radiations (light, X-rays, radiant heat), but also the kinetic (and possibly intensely concentrated electromagnetic) energy of material particles such as α-particles and electrons, including β-rays. The subject of photochemistry in the narrower sense has already found extensive treatment, and in the volume under notice the forms of radiation considered are limited to α- and β- particles, γ-rays, recoil atoms, positive rays and electrons, including the corona, silent, and spark discharges. Visible and ultraviolet light and X-rays are, however, dealt with to a certain extent.

It will be obvious that the subject is still so new as to be mainly in the empirical stage, and even on this side the results are not numerous, since, on account of the scarcity of radioactive material, only a limited number of investigators have had opportunities of making experiments in this field. It is true that in numerous patent specifications the use of "rays" of all kinds is vaguely adumbrated, including the stimulation of the reactions in the sulphuric-acid chamber by radium, but these contributions to our knowledge have no doubt been inspired more by that profound respect engendered by ignorance than by any actual scientific information in the hands of the practitioners concerned. Even on the scientific side, certain alleged transmutations of elements brought about by radium emanation have now proved to be of a premature character, although recent work again holds out promise in this direction.

After a brief but clear account of the phenomena of radioactivity and ionisation (induced by electrons, β-, γ-, and X-rays), the author considers the various effects of rays on matter. The kinetics of chemical reactions produced by radium emanation and the photochemical equivalence law, with the applications of the quantum theory are discussed. The latest work, including that of Rutherford on the collisions of α-particles with nitrogen atoms, and the breaking down of the elements into hydrogen, is included. The discussion is based on the hypothesis that the effect of α-rays and electrons is mainly due to the positive and negative ions they produce, and that the amount of chemical change is predicable by Faraday's law from the ionisation: the action is "electrolysis without electrodes." Although an α-particle produces 237,000 pairs of ions in its total path in air, the sum total of the action is usually small; chemical changes are often brought about with enormously greater rapidity by exposure to ultraviolet light.

The grains of wheat have been ably sifted by Dr. Lind from a large mass of scattered publications, and his book is a valuable contribution to modern chemical literature.

J. R. PARTINGTON.

TECHNOLOGY OF CELLULOSE ESTERS. *By* EDWARD C. WORDEN. *In ten volumes. Vol. I. in five parts. Pp.* cccclxxiii. + 3709. (*London: E. and F. N. Spon.* 1921.) *Price* £10 10*s. net.*

The magnitude and scope of this colossal work has prompted an American contemporary to apply to it the apt description of a "Cellulose Ester's Beilstein." The whole series is divided into ten volumes, of which the present issue of five heavy books, constitutes only Vol. I. Vol. VIII., dealing with cellulose acetates, was published as an isolated and preliminary instalment in 1916, owing to the sudden prominence assumed by these esters during the war. When the whole ten volumes are finally completed, they will embody the monumental achievement of the author's life-work. Reference must be made to the publisher's prospectus for a detailed survey of the scope of the work, and only a cursory survey can be undertaken here.

Part I. comprises extensive introductory monographs on cellulose, starch and cotton, the basic raw materials of the industries concerned. The monograph on cellulose covers 388 pages, and would in itself constitute a memorable publication. Comparing it with the two principal existing treatises on this subject, it may be said that it is more "practical" and methodical, though less personally inspired, than Cross and Bevan's well-known book, and that it is more "vital," though more condensed than Schwalbe's hand-book. Further it is considerably more "modern" than either, and, in fact, carries on the story of cellulose research with an insight and perspective ranking with anything that has been done before.

The chapter devoted to starch is necessarily more restricted, corresponding to the secondary importance of this material in relation to the main subject; consequently the ratio of foot-note references to text is somewhat larger. However, a well-connected account of the chemistry, physics, and industrial manufacture of the various types of starch is given that will cover all the requirements of the general technologist, whilst for the specialist who would dig more deeply the foot-notes constitute a literature and patent index, which is probably unique so far as this subject is concerned, and certainly so in the English language.

The section on cotton (two chapters) begins with a collection of botanical, microscopical, dimensional, and physical data relating to cotton as cotton, as distinguished from the chemical substance cotton-cellulose. Of particular interest is the section on the hygroscopic relationships of the cotton fibre. The industrial portion of this topic "Cotton" is noteworthy on account of the enormous development in the utilisation of the short-fibre grades of cotton wastes during the war. A demand then arose which produced what was equivalent to a revolution in the prevalent ideas and methods of treatment, and the short-fibre grades, which previously were only struggling for recognition as raw materials for the plastic industries, became of first importance. Dr. Worden's unique collection of scientific and industrial data, highly systematised, was of fundamental assistance to the United States and Allied Governments, and in his official capacity, the author was intimately associated with all the industrial developments and changes involved in the manufacture of cellulose esters on a scale hitherto undreamed of.

As a consequence, we have, not only as regards the preparation and treatment of cotton, but also very notably in the manufacture of nitrating acids, a work which embodies the most recent experience in the most extensive field on both sides of the Atlantic. The industrial information which has been put at the author's disposal for unification and record could not have been entrusted to more able hands.

Part II. deals with nitric and sulphuric acids, and is a 900-page volume constituting a complete account of these industries from the most modern point of view. The author's special system of recording and classifying references to literature and patents makes this volume of unique value. Both the nitric- and sulphuric-acid sections comprise in the first place all the recorded chemical, physical and analytical data, and secondly the most important and exhaustive accounts of the processes and methods used at the large British munition factories (Gretna and Queensferry) during the latter part of the war. There are also descriptive accounts of the latest contact processes, both for the fixation of atmospheric nitrogen and for the oxidation of sulphur dioxide. Besides the various contact processes for the manufacture of sulphuric acid, the old chamber process is fully discussed in its most modern development of intensive working. A chapter is devoted to the treatment of mixed acids, denitrations, and the theory of the regeneration of spent acids.

Part III., on nitrocellulose, is divided into three sections, theoretical, industrial nitration, and analytical. In many respects this volume is the best of the series and the one in which the author is able to give most play to his own vast personal experience and observation. The scientific section gives a full *résumé* of all the published data relating to the chemistry and physics of the nitrocelluloses set out in a clear and connected form, the first chapter comprising a historical survey of the development of the industry. Questions of solubility, viscosity, inflammability, optical, electrical and ballistic properties are discussed at length. A considerable section is devoted to the description of nitrates of starch and carbohydrates other than cellulose. Storage and transport regulations in various countries are detailed. The technical portion of the book contains a profusely-illustrated collection of various factory processes embodying all the most modern methods practised during the war, including the Thompson displacement processes both for nitration and dehydration, the centrifugal process, the Dupont, the Nobel, and several other systems. All the factory operations of washing, pulping, stabilising and dehydrating are discussed. Details of the lay-out and operative efficiency of the British Government plant at Gretna are included, and the various colloiding processes are described. The analytical section contains all the latest information on the various specification tests.

Part IV., describing the historical development of the cellulose ester industries, practically affords a bird's-eye view of the subject-matter which will be dealt with in fuller detail in the succeeding volumes of this work. It collects in a reasonable space the whole story of the cellulose ester industry in a perspective form and covers the whole field of solvents and plastic applications of these esters. Owing to the vast space occupied by this subject in technical literature, the foot-note references here bear a far higher ratio to the descriptive text than in the other parts of the work. The incorporation of this historically-arranged survey is an extremely happy and useful feature of the author's method. To the research worker it constitutes a classified card-index system of the previous literature that is of inestimable value.

Part V. contains in a separate volume the collected indexes of the other four parts of the work. Indexes of patent numbers, authors' names and subjects are included in this book, so that the contents of any of the others can be searched with a maximum of utility and a minimum of labour.

Reviewing the work as a whole, a first glance may bewilder owing to the vast mass of detail, but the reader will find that his respect for the author's achievement deepens the more closely he examines any particular portion which he is qualified to judge. On second thoughts it may be doubted whether the comparison with "Beilstein" does sufficient justice. As a matter of fact there are two books running concurrently in this work, one the large-print descriptive text and the other the small-print foot-notes and references. The work is not merely an encyclopædia, such as could be strung together by a committee of card-index experts, but displays a unity of purpose and correlation of ideas which reveal the author as the creative spirit behind the formidable array of recorded facts.

The reproach is sometimes made against works of this character that all the patented and advertised processes receive recognition without sufficient guidance from the author as to which are acceptable and which have died at birth. In the present case the author has anticipated this criticism, and specifically disclaims the position of judge or arbiter of the quality of the work of others which it is his duty to record. An idea which fails in the hands of its originator may be taken up later and form the seed of a successful invention in more favourable circumstances. Moreover, in a record such as this, which aims at completeness, the discriminating reader will detect a sort of "natural selection" at work. Those ideas which have germinated and borne fruit have also brought forth a vast host of references to literature and subsidiary patents, and their relative importance is sufficiently indicated by the space which has necessarily had to be devoted to all their ramifications. The author claims that the absence of any alleged matter from his collective indexes is evidence that it was "ephemeral, irrelevant, inaccurate, non-existent, or valueless." It is important to note that all references to literature and patent numbers have been individually verified at the source, and accuracy and completeness are the keynotes of the work.

J. F. Briggs.

Chemical Technology and Analysis of Oils, Fats, and Waxes. *By* J. Lewkowitsch. *Edited by* G. H. Warburton. *Sixth edition, entirely rewritten and enlarged. Vol. I. Pp.* 682. (*London: Macmillan and Co., Ltd.* 1921.) *Price* 36*s. net.*

The original work of the late Dr. Lewkowitsch is so well known and serves such a useful purpose to those concerned with the industries with which it deals that it is quite unnecessary to summarise its virtues. Therefore the task left to the reviewer is merely to verify the statement on the fly leaf that the volume has been "entirely rewritten and enlarged."

We find the new volume to consist of 682 pages, some 14 more than in the fifth edition, and it soon becomes apparent that this trifling enlargement is chiefly made up of paragraphs and footnotes introduced into the original text, which is so little altered that the present edition almost constitutes a reprint. This book of Lewkowitsch has been in the past the standard work on its subject in this country, and if it is to maintain this position, it must be kept up to date in detail by copious additions and considerable deletions. The present production is indeed a very great disappointment, so much so that the possessor of Vol. I. of the fifth edition will hardly consider it worth while to purchase this new volume.

It is only fair to the editor that one should carefully bear in mind that the period of seven years which has elapsed between the fifth and sixth editions is one in which very much less work has been published than during normal times of peace. Rapid advances were, however, made in many directions, and of the publications which are available comparatively few have been referred to. The Report of the Committee of Analysts of the Ministry of Food (Oils and Fats Section), which contains so much useful data and proposed standard methods of analysis now more or less generally adopted, has not been cited. To take a trifling example in this connexion alone, no working details are to be found of a modern method of estimating moisture in an "acid oil" containing volatile acids, such as coconut "acid oil."

In view of all this it seems it would be more correct merely to describe the volume as having been "revised" rather than "entirely rewritten."

E. R. Bolton.

Thermodynamics and Chemistry. *By* F. H. Macdougall. *Pp.* 391. *(New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.,* 1921.) *Price* 30*s. net.*

The importance to the physical chemist of a sound knowledge of the principles of themodynamics and their applications to chemistry is so great that one is always prepared to welcome any attempt to make the study of the subject more intelligible to the student. Professor Macdougall has set out to write a book "to meet the needs of advanced students of chemistry," including the organic chemist. Anyone who endeavours to fulfil this aim is confronted with the problem of how much mathematical knowledge he is to assume the student possesses. Professor Macdougall takes the bold line that the student must be familiar with the calculus, and offers "no apology for the considerable number of mathematical equations which will be found throughout the book." In this he is right in principle, but he has carried the principle too far; a good deal of the mathematics is unnecessary for the student of chemistry, who will tend to become confused and to miss seeing the wood for the trees. The author's boldness in this respect is all the more remarkable since he goes on to assume that the student for whom he writes is not too familiar with physico-chemical theory; he finds it necessary at the outset to refresh his memory of the elementary laws of gases, and of chemical combination, and at a later stage he gives, for example, rather a superficial account of such subjects as the hydrolysis of salts in solution and other applications of the ionic theory, with very little reference to thermodynamics. The book indeed suffers from a want of balance throughout; one hundred pages devoted to general considerations of the First and Second Laws are followed by a further hundred pages on the phase rule and its numerous applications. The author states in his preface that he does this deliberately in order to "furnish the student with numerous examples of the application of the principles of the science," but surely few teachers will agree that the application of the phase rule to such problems as the equilibrium between the various hydrates of ferric chloride and water, or to equilibria in ternary systems such as chloroform, acetic acid, and water, however important it may be in some respects, will give the student that insight into the principles of thermodynamics which a study of gaseous reactions will afford. Nevertheless, the author only devotes some twenty pages to equilibria in homogeneous gaseous systems, and there is no mention at all of such an example as that of the ammonia equilibrium, which is so instructive from a theoretical, and important from an industrial, standpoint. The application of the Nernst Theorem, or Third Law, to equilibria in gaseous systems is dealt with in about five pages, and the author's presentation of the subject appears to be taken largely from Nernst's "Thermodynamics and Chemistry," published in 1906, a book which, though historically interesting, is in many respects out of date.

A good text-book of thermodynamics for the chemist is admittedly difficult to write, but the author would probably have done better had he confined himself more to broad principles, illustrated by a comparatively few important examples worked out in detail, rather than by a large number treated incompletely. For more examples the student always can, and should, consult the original literature of the subject.

The book will need a good deal of revision before it can hope to hold its own with other text-books covering a similar ground.

There is a number of minor errors in the book, but perhaps this is inevitable in the first edition of a book of this nature. The publisher has not helped matters by omitting pp. 187—202 in the copy supplied for review and substituting a second set of pp. 171—186 inclusive.

H. T. Tizard.

PUBLICATIONS RECEIVED.

Les Colloïdes, Leurs Gelées et Leurs Solutions. *By* Paul Bary. *Pp.* 508. *(Paris: Dunod.* 1921.) *Price* 50 *fr.*

The Physical Properties of Colloidal Solutions. *By* E. F. Burton. *Monographs on Physics. Pp.* 221. *(London: Longmans, Green and Co.* 1921.) *Price* 12*s.* 6*d.*

Aggregation and Flow of Solids. *By* Sir G. Beilby. *Pp.* 256. *(London: Macmillan and Co., Ltd.* 1921.) *Price* 20*s.*

Technical Records of Explosives Supply. 1915—1918. No. 3. Sulphuric Acid Concentration. *Pp.* 91. *Ministry of Munitions and Department of Scientific and Industriol Research. (London: H.M. Stationery Office.* 1921.) *Price* 12*s.*

Forensic Chemistry. *By* A. Lucas. *Pp.* 268. *(London: Edward Arnold and Co.* 1921.) *Price* 15*s.*

Publications of the United States Geological Survey. *Department of the Interior. (Washington: Government Printing Office,* 1921):—
Sand-Lime Brick in 1920. *By* J. Middleton.
Asphalt and Related Bitumens in 1920. *By* K. W. Cottrell.
Fuller's Earth in 1920. *By* J. Middleton.
Bauxite and Aluminium in 1920. *By* J. M. Hill.
Silica in 1919. *By* L. M. Beach.

American Sulphuric Acid Practice. *By* P. De Wolf *and* E. L. Larison, *with a special chapter by* W. M. Le Clear. *Pp.* 270. *(New York and London: McGraw-Hill Book Co., Inc.* 1921.) *Price* 21*s.*

THE SOCIETY'S VISIT TO CANADA AND THE UNITED STATES.

CANADA.

The Society has on two previous occasions held its Annual Meeting outside of Great Britain, and on each of these it was held in New York. The desirability of holding a meeting in Canada had long been present in the minds of the members of the Council and of the Society's Canadian officials, and the year 1915 was fixed for the event, but owing to the war the project had to be abandoned. The Council and the Canadian members of the Society felt, however, that the plan should be carried out at the earliest possible opportunity, and an invitation from the Montreal Section received last year was unanimously accepted at the Annual General Meeting at Newcastle. As prior to the proposed meeting in 1915 a promise had been made to the Canadian Executive that a Canadian member should be nominated as President for the succeeding year, the Council invited the Canadian Sections to select one of their representative members for nomination to the office. Prof. R. F. Ruttan was chosen unanimously, and he was duly elected on August 29.

Owing to the adverse industrial conditions in England, it was unfortunately impossible for many members, who would otherwise gladly have participated in the trip, to go to Canada to attend the Annual Meeting of the Society. However, twelve members, some of them accompanied by their wives, sailed on the Canadian Pacific steamship "Melita" from Liverpool on August 12, under the leadership of Sir William J. Pope, the General Secretary and the Advertisement Manager being among the party. This number was subsequently increased by members who joined the party at various places *en route*. The voyage was most enjoyable, and the passage to Quebec was accomplished in record time for the vessel.

Quebec.

Upon arrival at Quebec the visitors were met by Dr. R. F. Ruttan, Mr. T. H. Wardleworth, Dr. Milton Hersey, and Dr. McLean, all of Montreal, together with Mr. M. L. Davies, the chairman of the Toronto Section of the Society, all of whom extended a hearty welcome to the British delegates. From the Chateau Frontenac, as headquarters, the visitors were taken to many places of interest in the neighbourhood, including the celebrated shrine of St. Anne de Beaupré, and had the pleasure of lunching with Sir Charles Fitzpatrick, G.C.M.G., Lieutenant-Governor of the Province of Quebec, at his residence at Spencer Wood, and also of dining at the Garrison Club on the invitation of Dr. Ruttan. On this occasion they had the good fortune to meet Sir George Garneau, a distinguished authority on all matters relating to the Province, who gave the guests a very full account of the social and economic conditions and requirements of the Dominion. Sir George Garneau also acted as guide in a drive around the city, and gave a most interesting account of the historic fight which took place on the Plains of Abraham, over which the party was conducted.

Montreal.

On leaving Quebec the party entrained for Murray Bay, 90 miles down the St. Lawrence, where a most enjoyable week-end was spent. The arrangements included a drive up the Murray River and a visit to Ex-President Wm. H. Taft. Proceeding to Montreal, the visitors received a most hearty welcome from the members of the Local Committee. Whilst in Montreal the members stayed at the Windsor Hotel, and as very complete arrangements had been made for their comfort and entertainment it is unnecessary to say that their stay in the city was a most enjoyable one. The Annual Meeting of the Society and subsequent conferences, luncheon, and banquet were all well attended and were thoroughly enjoyed. In addition to these functions, visits were paid to many places of interest in the city, including Mount Royal, McGill University, and the Cathedral of Notre Dâme. An interesting episode was a trip around the harbour in the Commissioners' yacht, and a visit to the huge grain elevators in the neighbourhood. The industrial features of the district were not neglected, and visits were made to the following plants:—Borden Farm Products Milk Pasteurisation, St. Lawrence Sugar Refinery, Gillette Safety Razor Co., Dominion Engineering Works, Canadian Pacific Railway-Angus Shops, National Electro-Products Co., and the Montreal Locomotive Works. Mention must also be made of a delightful garden party at McGill University, a visit to Laval University, an afternoon spent at the McDonald Agricultural College, St. Anne de Bellevue, and the regatta of the Grand Trunk Railway Boating Club at Verdun, all of which were thoroughly enjoyed by those who attended them. Much private hospitality was received from the Canadian hosts, and the University Club of Montreal extended its privileges to the members of the party.

The following were the chairmen of the various committees appointed to look after the local arrangements:—General Committee: Mr. H. W. Matheson; Hotel Committee: Major Adams; Registration and Membership Committee: Mr. Ross Gilmore; Programme Committee: Mr. C. R. Hazen; Papers Committee: Mr. Robert Job; Trips Committee: Dr. A. R. M. Maclean; Finance Committee: Mr. A. Neighorn; Publicity Committee: Mr. H. J. Roast; Reception Committee: Dr. R. F. Ruttan; Entertainment Committee: Mr. T. H. Wardleworth. The General Committee was composed of the above-named gentlemen, together with Mr. W. P. Dickson (secretary), Dr. G. Baril, Mr. J. B. Bell, Mr. F. E. Cornell, Mr. Fortier, Mr. J. E. Hayden, Mr. F. W. Horner, Mr. G. D. McIntyre, Mr. W. B. Woodland.

Shawinigan Falls.

From Montreal the visitors went by train to Grand Mere, where they inspected the power works and the pulp and paper mills, and thence to Shawinigan Falls, where they were entertained by the Local Section. After luncheon had been taken at the Cascade Inn, the party drove in automobiles to visit the power-house and the works of the Canada Carbide and the Canadian Electro-Products companies. At an informal dinner given to the visitors in the evening the toast of the King was proposed by Dr. F. W. Skirrow, the chairman, who also welcomed the visitors from overseas. He said that the Shawinigan Falls Section was proud to welcome the members from overseas, individually as representing the best traditions of British chemical industry, and also collectively as being the parent Society of which the Local Section was the youngest offspring. They were especially proud to be able to couple the toast with the name of Sir William Pope, whose masterly series of researches on the optical activity and asymmetry of certain nitrogen compounds, and the brilliant imagination with which he had formulated a mechanical connexion between chemical constitution and crystalline form had brought him to the front rank of investigators, whilst his researches on mustard gas, which were better known to the man-in-the-street, had contributed towards the successful termination of the war. In reply, Sir W. Pope expressed his delight with his visit to Shawinigan Falls. Mr. R. H. Clayton said that he had been immensely impressed with the enormous natural resources of Canada. He emphasised the difference in the character of the problems facing the industrial chemist on the two sides of the Atlantic; whereas Canadians would be fully occupied in developing their existing resources for many years to come, they in Europe, to whom nature had been less lavish, must depend for their industrial expansion exclusively on the introduction of new and more economical processes. The toast of the American members was given by Mr. R. A. Witherspoon and replied to by Prof. W. A. Noyes and Messrs. C. E. Scholes and L. E. Saunders.

Dr. Ruttan then proposed the toast of the "Baby Shawinigan Falls Section." He expressed his pleasure at being among so many former McGill students of chemistry who were now connected with the industries. Another reason why everyone liked to come to Shawinigan Falls was its well-known hospitality. This Section of the Society of Chemical Industry would not long be the baby section in Canada, for a new one might come into existence during the coming year. These local sections of a great international organisation were far more important and possessed greater prestige than a purely local society. Although each of the Canadian Sections was in the infantile stage at present, they were robust and would develop into strong chemical organisations. Prof. Lash Miller of Toronto also expressed his great interest in what he had seen in Shawinigan and his confidence in the future development of its industries.

During the afternoon the ladies of the party were taken for a motor drive round the principal scenic points and had a unique opportunity to admire the beauties of the falls, the gates being opened by the courtesy of the superintendent of the power-house. They were afterwards entertained by the ladies of the Committee at the home of Mrs. Skirrow.

Ottawa.

On leaving Shawinigan Falls train was taken to Ottawa, and upon arrival there special cars conveyed the party to the Rivermead Golf Club at Deschenes, where luncheon was provided. Subsequently, some of the members paid a visit to the British American Nickel Corporation's plant, and others visited the Parliament Buildings in the city; later in the afternoon the whole party was taken by automobile to the Dominion Government Experimental Farm, where tea was provided, and where they were entertained by the Deputy Minister of Agriculture, the Director of the Farm, and Dr. F. T. Shutt, the Government Chemist. In the evening the Ottawa Section gave a dinner at the Château Laurier Hotel, at which Mr. F. J. Hambly presided, and one of the speeches was made by the Hon. Gideon Robertson, Minister of the Interior.

Toronto.

The journey to Toronto was made by night train, and on arrival the members were supplied with accommodation at the University residences. After a short tour of the University Buildings, a trip was made on the Harbour Commissioners' boat in order to inspect the harbour development and improvements, following which the members were entertained at luncheon by the Toronto Section, except the President and one or two others who were similarly entertained at the Exhibition Grounds by the Directors of the Canadian National Exhibition. In the afternoon a drive was taken through the city to the Exhibition, where the party was received by the officials, and in the evening a dinner was given by the Local Section, Mr. M. L. Davies presiding, followed by a tableau and grandstand entertainment in the grounds, at which a crowd of many thousands was present.

THE UNITED STATES.

International comity in chemistry was the keynote of the visit of the Society of Chemical Industry to the United States as the guest of its American Section and of the American Chemical Society. The occasion brought the overseas delegation into close touch with leaders of American chemistry in all its branches and gave the opportunity for an interchange of ideas which has resulted in closer union between the English-speaking workers in chemical science and industry.

Niagara, Buffalo, and Syracuse.

On Monday, September 5, the visitors proceeded by steamer across Lake Ontario to Lewiston, New York, and travelled thence by cars over the Gorge Route to Niagara Falls, where some time was spent visiting points of interest. The next day the party was taken by motor to Chippewa to inspect the power developments and plant of the Hydro-Electric Power Commission. After lunching at the Refectory at Victoria Park, members were conveyed in motor-cars, across the International Bridge, to the Country Club, where arrangements had been made for a reception to be given them by Governor Miller, of New York State. Unfortunately, Governor Miller was unable to be present, but General Kincaid extended the welcome to American soil on his behalf. Other distinguished Americans present who joined in the reception were Mr. S. R. Church, chairman of the American Section of the Society; Prof. E. F. Smith, president of the American Chemical Society; Dr. David Wesson, president of the American Institute of Chemical Engineers; Dr. Acheson Smith, president of the American Electro-Chemical Society; and Dr. William H. Nichols, past-president of the Society of Chemical Industry and of the American Chemical Society.

Leaving Niagara, the visitors journeyed to Buffalo, where they were taken for a most enjoyable drive through that magnificently planned city, and in the evening were entertained at dinner in the University Club by the Buffalo Committee, Mr. W. H. Watkins, of the National Aniline and Chemical Co., being in the chair. An interesting episode was the arrival during dinner of a telegram from the President of the United States, Warren G. Harding, addressed to the president of the American Chemical Society, which read as follows:—

> "It is a pleasure to extend greetings to the gathering of American, Canadian, and British Societies representing the chemical sciences and industries meeting on American soil. Probably none of the materialistic sciences holds promise of so great contributions to human welfare in the coming generation as that which your organisations represent. The developments of applied chemistry involve both the possibility of vastly increased horrors in human conflict and, alternatively, inestimable benefits to a peaceful civilisation. Let us hope that a science so fraught with either good or vicious possibilities may be turned, through the wisdom of the nations, to the benefit and advancement of mankind."

After dinner the party entrained for Syracuse, which was reached early next morning. Following breakfast with the Local Committee at the Onondaga Hotel, the members visited the Solvay Process Plant, were shown over the works where the ammonia-soda process is in operation, and were entertained to lunch by the company. Subsequently they proceeded by train to Albany, where some of the members had a delightful drive round the city. From Albany they transferred to the steamer "Berkshire" and proceeded down the River Hudson by night to New York. This was a most interesting experience, the shores being alternately lighted up by searchlights from the steamer.

New York.

New York City was reached early on the morning of September 7, after a delightful trip down the Hudson River, lined on either side by flourishing American cities. How greatly industrial chemistry contributes to American life appeared in the large manufacturing plants on the New Jersey side of the stream, just at the end of the sheer trap-rock walls of the Palisades. There are the towering stacks of huge chemical works where crude acids, corn products of various kinds, sugar, and many other products are made on a large scale. On arrival the visitors were met by a committee of the American Section of the Society of Chemical Industry and also by the heads of the committees on transportation and information representing the American Chemical Society; they were at once driven to Columbia University, where the American society was holding its Autumn Meeting, and where they were to be domiciled, as the University session had not yet begun.

The opening or general meeting of the American Chemical Society was held in the gymnasium of the institution, which has seating accommodation for 3000 people. It was presided over by Dr. Edgar Fahs Smith, the president of the American Chemical Society and Provost-Emeritus of the University of Pennsylvania, after the address of welcome had been delivered by Dr. John E. Teeple, chairman of the New York Section of the American Chemical Society. Mr. Francis P. Garvan, the head of the Chemical Foundation, which took over the control of the German dye patents in the United States, delivered an address upon "Chemistry and the State," in which he emphasised the need of keeping a sharp scrutiny on the continued efforts of Germany to dominate the chemical industry of the world. Sir William J. Pope spoke on "Mustard Gas," and Dr. Ruttan described the "Organisation of Industrial Research in Canada."

After the meeting, the British and Canadian chemists were entertained at luncheon at the Hotel Pennsylvania by the members of the American Section of the Society of Chemical Industry. Mr. S. R. Church, of New York City, took the chair, and brief addresses were given by Dr. William H. Nichols, who made the first public announcement that at the Solvay works in Syracuse, New York, the fixation of atmospheric nitrogen was being conducted by the Allied Dye and Chemical Co. on a commercial scale; by Brig.-Gen. Amos A. Fries, director of the U.S. Chemical Warfare Service, who described the present status of that branch of the American army; and by Sir William Pope and Dr. Ruttan. There were present 150 guests, and the function was one of the most enjoyable on the programme. The arrangements for it had been made by Mr. C. E. Sholes, of New York, a former chairman of the American Section, and the floral decorations had been made under the direction of Mrs. Leo H. Baekeland, who with Dr. Baekeland had done much to add to the pleasure of the overseas delegation.

American hospitality is continuous, for by 4 p.m. the same afternoon the visitors found themselves at a lawn party on the shaded campus of Columbia University, whose guests they were for the remainder of the afternoon. Fully 2000 people attended this function. Vividly and typically American was the "Smoker," the informal entertainment of the American Chemical Society, held in the evening at the Waldorf-Astoria, to which the chemists from abroad were especially invited. Fifteen hundred chemists, divested for the time of coats and waistcoats, made thoroughly comfortable and at ease, despite the hot night, well supplied with cigars and cigarettes and what is called "beer"—for Prohibition prescribes that malt beverages in America shall contain not more than one half per cent. of alcohol—enjoyed a rollicking vaudeville entertainment. One of the skits, "What is a Chemist?" written by Mr. Elwood Hendrick, was a short costumed play in which Uncle Sam, John Bull, and the two societies were impersonated. Its motive was to show that the manufacturer on both sides of the Atlantic should see to it that chemical research as applied to his industry should in no wise be slackened. The amateur actors, who were members of the New York Section, enacted their rôles with spirit and enthusiasm, and the author himself took the part of a manufacturer. Verses of topical songs, written for the occasion and abounding in witty comments upon well-known chemists, were flashed on the screen, as well as exceedingly clever caricatures of some of those present.

One of the most important events was the International Meeting held on the afternoon of September 8 in the Great Hall of the College of the City of New York. This convocation was in effect a symposium on "Chemistry and Civilisation," which was designed by an International Committee, under Dr. Charles Baskerville as chairman. Dr. Edgar F. Smith presided, and the sequence of the items in the programme, admirably conceived, represented a logical development of chemical science. The formal statement of the subjects was as follows:—Science and Civilisation; The Rôle of Chemistry.—Dr. Chas. Baskerville; Energy: Its Sources and Future Possibilities.—Dr. Arthur D. Little; The Engineer; Human and Superior Direction of Power.—Dr. Leo H. Baekeland; Chemistry and Life.—Sir William J. Pope; Theories.—Dr. Willis R. Whitney; Research Applied to the World's Work.—Dr. C. E. K. Mees; Problem of Diffusion and Its Bearing on Civilisation.—Prof. Ernst Cohen (University of Utrecht); Catalysis: The New Economic Factor.—Prof. Wilder D. Bancroft.

Many members of the Society of Chemical Industry took part in the sessions of the fifteen Divisions and Sections of the American Chemical Society, either by reading papers or by joining in the discussions. In the newly-founded Section of Leather Chemistry papers were read by Prof. H. R. Procter, Messrs. A. Seymour-Jones, and J. T. Wood. Dr. F. W. Atack was the first speaker in the Division of Organic Chemistry, and Prof. G. S. Whitby, of McGill University, with A. H. Smith, of Trenton, N.J., read a paper on vulcanisation in the Division of Rubber Chemistry. The Canadian Section was also represented in the Division of Dye Chemistry, Mr. W. F. Prescott, of Montreal, being the author of a paper on "The Dye Situation in Canada."

At the banquet held in the Astor Gallery of the Waldorf-Astoria on the night of September 8 the chemists from both sides of the Atlantic cemented their friendships and informally discussed the future of their science. Dr. John E. Teeple, chairman of the New York Section and the president of the Chemists' Club, presided. Among the speakers were Dr. Edgar F. Smith, Sir William Pope, Prof. Whitby, Brig.-Gen. Fries, and Prof. Bancroft.

Before Dr. Smith delivered his presidential address on the evening of September 9, another point of contact between the chemistry of the United States and of the Mother Country was emphasised by the presentation of a portrait of Joseph Priestley, which is to be hung in the National Museum at Washington. It is a copy of the original by Gilbert Stuart, who in his time practised his profession both in London and Philadelphia. In his address, Dr. Smith referred at length to the beginnings of American chemistry as founded by men who had been trained in the institutions of learning beyond the seas.

Although this address brought to a close the formal proceedings of the American Chemical

Society, visits to industrial plants formed a valuable feature of the programme. Among the works visited were the National Biscuit Co.; the Ladew Leather Co.; the Ziegel Eiseman Co.; the American Tobacco Co.; the Standard Oil refineries in Bayonne, New Jersey, and on Long Island, New York; the Manhattan Rubber Co.; the Passaic Print and Dye Works; the Seaboard By-Product Coke Co.; and Liebman's Brewery. It was at this last establishment that the visitors witnessed the picturesque process of de-alcoholising the brew, so as to make it legally saleable under the Prohibition Act. Chemists were much in evidence at all these works, for although some firms are curtailing research work, the chemical control of American industries is well maintained. It is an interesting and significant fact also that in many of the American plants the direction of operations is in the hands of young chemists, for in the United States heavy responsibilities are placed upon professional men early in life.

Visitors from abroad cannot but be impressed with the attention which the lay Press gives to chemical matters. During the progress of the meetings in Canada and the United States the newspapers gave considerable space to the reports of the proceedings. This interest on the part of the newspapers has been stimulated greatly by the News Service established by the American Chemical Society. During the New York meeting, this organisation had a "Press Room" in Columbia University, from which popularised abstracts of papers were distributed to the members of the Press, and copies of speeches to be delivered were issued in advance to the news associations, such as the Associated Press, the United Press, and Reuters' Agency.

Another agency for the dissemination of chemical knowledge to the general public is the Chemists' Club, of New York City, which maintains a large library of works on chemistry, to the use of which the layman is welcome. It occupies a handsome, ten-story structure at No. 52 East Forty-first-street, not far from the New York Public Library, and in it are held the meetings of the American Section of the Society of Chemical Industry as well as those of the New York Section of the American Chemical Society. It also contains laboratories which are rented by many well-known American chemists. It was at the Chemists' Club, the facilities of which were offered to foreign visitors, that there was held on the evening of September 13 an informal dinner and conference in which the officers of the Society of Chemical Industry in the city took part as the guests of the American Section. After dinner there was an animated discussion as to the best means of extending the work of the Society on the American continent, for it was the general opinion that the meetings held in New York would assist materially in enabling American chemists to obtain a clearer understanding of the aims of their colleagues across the Atlantic.

Many of the rooms in the Chemists' Club are used as the meeting places of committees and smaller groups. In one of these sat the Co-ordinating Committee, composed of members of the American and the British Societies, under whose direction the arrangements for the American visit of the chemists from Europe and Canada had been arranged. At the head of this committee was Dr. B. C. Hesse, the other members being Dr. John E. Teeple, ex-officio, Mr. S. R. Church, chairman of the American Section, Dr. Allen Rogers, secretary, and Prof. J. E. Zanetti.

Any account of the New York Meeting would be incomplete without reference to the many entertainments provided for the families of visiting chemists. There were theatre parties, excursions to the large shops, a tea and dance at the home of Mrs. Charles F. Chandler, and a garden party at the residence of Mrs. Elon H. Hooker, at Rockbridge, Greenwich, Conn. While the British and Canadian chemists were waiting for the second half of the "Chemical Fortnight" there were numerous social functions given by American friends, and week-end visits to country homes in New Jersey and on Long Island.

The National Exposition of Chemical Industries was held from September 12 to 17, inclusive, in the Eighth Coast Artillery Armory, in the Borough of the Bronx, New York City. The exhibits, which touched on every phase of engineering and manufacturing chemistry, were disposed on one floor, with broad aisles through which the public could wander at will and observe the processes of applied chemistry and inspect its manifold products. The dye industry particularly was well represented. To the visitor from other lands the impression gained of the vast material resources of the United States was very vivid. As the exposition drew to a close some of the representatives of the Society, including Sir Wm. Pope, embarked at the port of New York for the homeward journey to England, leaving others to spend a few more days in the States and Canada before returning home.

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Now that the meetings are over, one realises that through the exceedingly well-planned arrangements devised by the Committees of the Sections in Eastern Canada and America, those who participated in the trip accomplished far more in the few weeks at their disposal than could possibly have been anticipated. The visit to the American continent was of the highest value in bringing together the members of the Society in England with their fellow-members on the other side of the Atlantic, and it gave those office-bearers of the Society who took part in it an opportunity to get into touch with the Canadian and American Sections. This should lead to closer co-operation between the far-separated parts of the Society, and to more united effort in promoting its interests. The keen interest taken by our overseas members in the affairs of the Society was very striking, and it is anticipated that much benefit will accrue from the numerous conversations that were held concerning the organisation of the Society's branches in Canada and elsewhere, the value of the Journal, and allied topics. There is no doubt that the Journal is very highly appreciated by chemists throughout the American continent, and that particular value is attached to the Abstracts and the news published in the Review, which is not otherwise accessible to overseas readers. That the visit has done much to strengthen the position and prestige of the Society in Canada and the States was the impression of every member of the visiting party, and that this view is also shared by those on the other side may be judged from the following remarks recently received in a letter from Mr. M. L. Davies, chairman of the Toronto Section:—"Your visit has inspired all the Canadian Sections, and I feel sure will result in a greater interest in the Society. We live a long way from headquarters, and the clasp of the hand means a great deal more than the cold type of the Journal in making us feel that we belong to the same organisation. I venture to say that it would be difficult to estimate the good results that will inevitably follow the visit of our members from the Old Country no less than the good fortune of having a President from the Dominion."

The grateful thanks of the Society are most cordially given to Dr. Ruttan, its new President, to Mr. T. H. Wardleworth, its Canadian Vice-President, and to the Executive Committees at Montreal, Shawinigan Falls, Ottawa, Toronto, and New York, to the chairmen and secretaries of these Sections, and to all the ladies and gentlemen who gave such valuable assistance to them in providing for the comfort and entertainment of their guests. The visitors were simply overwhelmed with the generous and gracious hospitality extended to them in every place they visited, and they will never forget the forethought and the kindness that have made the visit to Canada and the United States a unique event in their lives.

OUR ANNUAL MEETING, 1921.

SIR WILLIAM POPE.

A year or more ago, when our Society accepted the kindly invitation of its Canadian members to hold the recent annual meeting in Montreal, the prospects of the chemical industries, and indeed of all industries, were excellent. Those prospects were not realised and, as it transpired, our annual meeting was held in the Dominion during an epoch of industrial depression and general unrest throughout the world. As a result of the universal dislocation of business and manufacturing activities which has occurred during the last year, only some twenty-five members of the Society were able to journey overseas to attend the annual meeting in Montreal. It is not to be supposed, however, that this number represents the attendance at the annual meeting; the members of our Canadian and New York Sections came in such numbers that all our meetings and functions were on the same—and sometimes on a larger—scale than those to which we are accustomed when the Society holds its anniversary in the British Isles.

Although our Canadian and American friends are passing through an economic crisis much resembling our own, they had prepared for a visit of one or two hundred English members and had arranged to meet us with characteristic hospitality; that hospitality was concentrated upon the smaller number of overseas' visitors in such a manner that none of those who attended will easily forget the warmth of the reception prepared nor the lavish generosity of the entertainment and instruction provided. It would be superfluous for me to attempt to supplement the official account of the annual meeting, but it may be useful to record a few points which might not legitimately find an appropriate place in a purely formal narrative of the meeting.

Our overseas' party was perhaps not quite prepared for the loyal and enthusiastic regard in which the Society of Chemical Industry is held amongst its Canadian members; I have already noted that the Canadian meeting was as large, and the sections as well attended, as if we had met in England. Our Canadian friends take the view that they, like those resident in the British Isles, are active working units in the Society; it will be unfortunate if we at headquarters do not esteem this feeling as one of our great assets and do not do all in our power to retain the adherence of our members in outlying parts of the Empire and take advantage, for the permanent benefit of British science and technology, of the different outlook and the wider horizon which our distant friends can bring to the councils of the Society.

Our incoming President, Dr. R. F. Ruttan, is the most distinguished figure in chemical science in Canada; his students occupy the most important positions in chemical science and chemical technology in the Dominion and, as a man of affairs, he is in close touch with the legislature on all matters concerning the corporate interests of our subject in Canada. By personality, attainment and achievement, the President stands out as the one man who can devote himself with certainty of success to the task of developing our five newly-established Canadian Sections with the object of making them larger and more powerful elements in our organisation. Dr. Ruttan deservedly brings with him the unanimous support of our Canadian members, and I am convinced that he can rely with confidence on the loyal assistance of members on this side of the Atlantic; and although he will not be able to be with us in England during the first part of his year of office, we can rest assured that he is working hard in the promotion of the common cause.

During our annual meeting I met large numbers of Canadian and American chemists, both members and non-members of our Society, and took every possible opportunity of eliciting views concerning the Society of Chemical Industry and its affairs. Many expressions of opinion were laudatory, more especially as concerns the standard of our original papers and the annual reports, but a few criticisms were constantly repeated and it may be useful to state the more important. I was often told that the general appearance or get-up of the Journal is not attractive and not such as to evoke curiosity. I am strongly of opinion that we should gain in membership and in interest by adopting a form of publication more in accordance with modern methods of producing technical literature; we have before us in the *Journal of Industrial and Engineering Chemistry* and in *Chimie et Industrie* excellent examples by which to learn. Approval was frequently expressed of our "Review," but again, and in general, with the reservation that it is not sufficiently activated by the journalistic spirit to make it of maximum utility. For the future welfare of the Society it seems essential that these and similar questions should be considered by the Council and prompt action taken.

At the close of our own annual proceedings and our meeting with our New York Section most of the overseas visitors became absorbed in the anniversary of the American Chemical Society, for which a large and comprehensive programme had been prepared. The American Chemical Society now comprises some 17,000 members and issues its *Journal*, devoted to original contributions of a scientific kind, the *Journal of Industrial and Engineering Chemistry*, made up of editorials, original technical articles, and matter of general chemical interest, and the "Abstracts," which are well on the way to becoming a complete set of abstracts of scientific and technical chemical literature. Practically the whole of the corporate interests of chemistry in the States is in the administration of this one Society; officially connected with it in one or another capacity is quite a number of active men who devote themselves vigorously to promoting the interests of the whole chemical community, by organisation of publications, of propaganda, etc., and whose efforts are supported by the whole chemical community. This concentration of interests into one organisation has led to great financial economy in management and administration, and has made it possible to throw the whole weight of collected chemical opinion in the country on to any particular question of general importance; it has enabled the American Chemical Society to exercise an influence in the legislature which counts quite seriously in political affairs.

Until chemical public opinion in this country bestirs itself and insists upon the establishment of an effective organisation handling the general corporate interests of chemists we cannot hope to see chemical science and technology take their proper place in the public estimation or to employ the subscriptions of the members of our numerous chemical organisations with due economy and with an adequate return.

THE MODERN DYESTUFF INDUSTRY.*

H. E. FIERZ.

The dyestuff industry is a branch of technical organic chemistry and is intimately associated with the progress of chemistry in general, for on the one hand this industry is stimulated by developments in pure science, and on the other, progress in this industry frequently influences and contributes towards the achievements of pure chemistry. The present chairman has dealt with this relationship in general terms in an admirable manner (M. O. Forster, J. Royal Soc. Arts, 1918, 66, 529—538), but, in view of the importance of the dyestuff industry, it appeared of interest to consider more closely the actual problems involved.

The value of the output of the dyestuff industry in 1913 was very small in comparison with that of other industries; it amounted to only £20,000,000, as compared with £120,000,000 for cotton, £240,000,000 for wool, £500,000,000 for cereals, £250,000,000 for pig iron, and £60,000,000 for rubber. In the same year Germany controlled at least 95 per cent. of this chemical production. Since then large works have been established in many countries, and there is now a general outcry for protection.

I estimate that before the war £10,000,000 was invested in the industry, and that the finished dyes were worth about double this sum. This proportion has undergone a great change, for at least £40,000,000 is now invested in the industry, and the products are still worth only £20,000,000, on account of the decreased demand. Profits, which have averaged about 16 per cent., must, therefore, fall below 4 per cent., because the general expenses are much greater than they were. In the United States, for example, the general expenses are at least five times as great as in Switzerland. Indigo plants, Alizarin works, and Azo units have multiplied, and there has been a very considerable over-production. The industry is full of change, uncertainty and unrest, and the expected profits have not been realised, which is not surprising when it is remembered that it would be possible to manufacture the world's requirements of dyes in a plant much smaller than Vickers' or Krupp's steelworks. In fact, one is tempted to alter the lines of the greatest Scotch poet to:—

> "But Dyestuffs are like poppies spread,
> You touch the flower, and it is shed. . . ."

The question arises as to how matters can be arranged so that the major portion of the capital invested in the world's dyestuff industry shall not be lost. Two problems must be faced:—(1) The development of the dyestuff industry proper, and (2) the employment of its surplus energy (capital and men).

The first condition of a successful colour industry is that its products should be of the very first quality and of absolutely uniform strength, shade, etc. In pre-war days the most minute deviation in the properties of a product would result in refusal of the goods and cause trouble between the producer and the consumer. In my opinion the maintenance of pre-war standards of quality is absolutely essential.

In the second place, there must be unceasing progress. Failure to advance means retrogression and leads to certain ruin, no matter how great the capital or the determination employed. The elimination of unfit works was witnessed forty years ago, and if history should repeat itself, it will be because the same mistakes have been made. The touchstone of efficiency in the industry is the free export of colours to the Far East. China and Russia, each as large as Europe, have absorbed, and will absorb in the future, 50—60 per cent. of the world's production of dyestuffs.

The directions in which progress can be made in colour chemistry, although more restricted than they were 25 years ago, are still numerous. Many of the existing products have become staple dyes. Alizarin, Indigo, Indanthrene, Chrysophenine, and Chrome Blacks, for example, are excellent, but there is no guarantee that any of them will survive serious competition from a new and better product. Already Indigo has to meet strong competition from Hydron Blue, Fast Blues, and sulphur dyes; Alizarin cannot enlarge its field, as strong competitors are appearing; and the tendency to employ better and more expensive dyes, which originated in England, may put an end to such old favourites as Fuchsine, Bismarck Brown, Congo Red, and others. There are many problems waiting to be solved, and the desires of the dyer in this direction are well known to all those engaged in this fascinating field.

An outline of the tendencies now apparent may be indicated by the arbitrary selection of a few facts of general interest. It has already been mentioned that one of the most important tasks of the dyestuff manufacturer is to produce goods of the greatest possible purity. The use of pure intermediates has frequently given rise to products of vastly improved yield and shade, of increased fastness towards light, and sometimes also towards potting and milling. Azo dyes intended for use in printing-inks often show great differences in properties when freed completely from impurities, for traces of naphthols and decomposition products, although quite colourless, may render them entirely unsuitable for this purpose. In some cases the properties of lakes are unexpected; Columbia Black FF (a complicated trisazo dye), for example, forms a calcium-barium lake which is so fast to light that its use in place of printing-carbon has been proposed; it possesses the additional advantage that it can be removed by bleaching, so that the waste paper can be readily recovered. In other cases the isolation of a pure compound has led to the discovery of a new class of anthraquinone dyes; thus Alizarin Saphirol is a constituent of Anthracene Blue and the mother-substance of R. E. Schmid's wonderful series of acid anthracene dyes.

The attempt to obtain purer and cheaper products has given rise to a large number of new processes. Thus, there are five different processes for the production of H-acid, three for chromotropic acid, three for gamma acid, and so on. The production of very pure intermediates has enabled the works chemist to try new combinations which could not be produced from impure starting materials.

The task of a chemist in a colour works and similar branches of technology has been compared with that of a man who has to find a needle in a haystack. I do not agree with this comparison, for provided the man is careful he will find the needle; but the chemist who does not possess a strong chemical instinct, amounting almost to genius, will find nothing. The great thing is not to find the needle, but to know whether there is any needle in the chemical haystack to find! I am convinced that the possibility of the discovery of new and valuable dyes is dependent not only on careful research, but on the existence of a traditional feeling and chemical inspiration in the research worker.

A few examples of the efforts directed towards increasing the number of good dyes may be quoted, taking the case of red shades. Alizarin is the best colour, but it is difficult to dye, consequently Congo Red has replaced it to a certain extent on account of its beautiful shade and in spite of its fugitive character. Congo Red is being gradually driven from the market and replaced by better dyes. Its competitors are mainly derivatives of J-acid

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* Based on a paper read before Section B (Chemistry) of the British Association, on September 10, 1921.

(2-amino-5-naphthol-7-sulphonic acid), and it is surprising how many combinations have been discovered. J-acid is transformed into ureas, thiazoles, aminophenylamines, aminophenylazimides, and benzylidene derivatives which are used in the production of Azo dyes, such as Rosanthrene, Benzo Fast Red, Zambesi Red, Diazo Fast Red, etc., and it remains to be seen which of the hundreds of combinations will remain on the market.

At the same time even better competitors have appeared. The old Para Red (p-nitrobenzeneazo-β-naphthol) was not a good shade, although very fast, and is being replaced gradually by diazotised 2-amino-4-nitrotoluene coupled with β-hydroxynaphthoic acid anilide (Naphthol AS), or with β-hydroxynaphthoic acid p-nitroanilide (Naphthol AN). The preparation of the anilide of 2.3-hydroxynaphthoic acid has given rise already to quite a number of new methods of manufacture (*cf.* G.P. 289,029 of 1915).

The struggle between Alizarin and its competitors finds a parallel in the case of Indigo and its competitors, for Indigo no longer reigns supreme: J-acid also lends itself to the production of very fast blue and violet polyazo dyes. The old and imperfect benzidine and dianisidine dyes are being replaced by these very fast colours which, on cotton, are superior even to Indigo. Hydron Blue, Indanthrene, Anthracene Blue and Alizarin Saphirol are very important competitors, and recently the complex chromium and copper salts of dihydroxyazo dyes have been threatening Indigo as a wool dye. Indigo is, however, still the most important dye, China alone requiring £2,000,000 worth per annum, but it seems safe to predict that it has passed its zenith and will now remain stationary like Alizarin.

The discovery of synthetic Indigo has resulted in new and quite unexpected intermediates. Substances such as chloranil and diketo-dihydro-thionaphthene-dimethylamino-anilide are now being proposed as intermediates, whilst the condensation of arylamino-naphthaquinone with oxythionaphthene gives rise to vat dyes similar to Friedländer's Thioindigo. Furthermore, the use of extremely complicated derivatives of penthiophene has been proposed.

Vat dyes in general have undergone a change which would have been regarded as impossible twenty years ago, and in this respect anthraquinone appears inexhaustible, although many of the new dyes are not as good as might have been expected.

It is not only Alizarin and Indigo which are threatened by competition; practically every colouring matter is open to attack. Changes in the industry are now slower than they were, but they are steady and unavoidable. What would be the result if every colour works has its Green, Sandmeyer or Perkin, together with its new pyrazolone, tetrahydronapthylamine or diaminobenzophenone? The slow changes indicated would be accelerated, and in fifty years the most complex compounds would be quite common.

Such considerations, however, cannot eliminate the fact that there is an over-production of at least 200 per cent. to-day. This over-production is strongly marked at the moment, but it has occurred before, when many products of excellent quality could be sold only with difficulty and at a loss. It is not surprising, therefore, that colour works have tried to find new fields of activity. There are several branches of technology that can serve to place dyestuff chemistry on a broader basis, for example, pharmaceutical chemistry, photographic chemistry, tanning chemistry, the chemistry of technical colloids such as celluloid, acetylcellulose, artificial leather, artificial horn, Bakelite, and finally heavy chemicals, nitric acid, sulphuric acid, acetic acid, ammonia, etc. The large Continental firms have, without exception, developed directly or indirectly along these lines.

Pharmaceutical chemistry was the first of these to be successfully attacked, for many of the intermediates for dyes can be transformed readily into valuable pharmaceutical products. The production of phenacetin, antipyrin, salvarsan, etc. would have been impossible had it not been for the experience gained in the dyestuff field. Similar competition prevails among pharmaceutical products, for antipyrin is replaced by pyramidone, veronal by dial and adalin, digalene by new preparations. The relations between dyestuffs and pharmaceutical products are even closer, for frequently dyes can be used advantageously for medicinal purposes. Quite thirty-five years ago Crystal Violet was recommended as a powerful disinfectant under the name of Pyoktanin, but with no great success. New compounds have, however, been discovered recently, such as the silver salts of many Acridine dyes, which are very powerful disinfectants and at the same time practically non-poisonous. These dyes are used as a rule on leather with a titanium mordant, but the discovery of their disinfecting properties may lead to the replacement of the poisonous phenol and cresol preparations, some of which are, nevertheless, excellent pharmaceutical products. Certain aminobenzoyl-derivatives of H-acid and similar aminonaphthol compounds, which possess a polypeptide character, are not only intermediates for dyes, but are also powerful poisons for blood parasites, and it may be that they will replace salvarsan!

Pyrazolones are to-day equally important for antipyretics as for the production of new colours in the Tartrazine series. Similar relationships exist between dyes and photographic chemicals; thus p-aminophenol is an important intermediate for sulphur dyes, and it is also a good photographic developer. Progress in colour chemistry has revolutionised the production of many photographic chemicals. The large-scale manufacture of plates and films was brought to perfection more particularly in the great colour works on the Continent. The manufacture of acetylcellulose is dependent on the large quantities of chlorine obtained in the electrolysis of sodium and potassium chlorides. Acetyl chloride is manufactured by the interaction of sulphur chloride, chlorsulphonic acid and sodium acetate. Camphor has been partly replaced by acetyl-arylamines. Acetylcellulose has proved an interesting substance from the point of view of kinematograph films, but it is scarcely of importance as a competitor of Viscose.

The large colour works were not sufficiently employed even after they had started the manufacture of pharmaceutical products, photographic chemicals, and celluloid, so that further profitable fields of activity had to be found. The tanning industry afforded such a profitable field, after it had been found that naphthols and phenols condensed with formaldehyde and sulphuric acid to form valuable tanning products, which are now used in large quantities, as well as Bakelite and shellac substitutes. The chief problem associated with these manufactures is the production of formaldehyde from coal.

The expansion of colour works affords one of the most remarkable phenomena in the whole field of technology, and it may be safely asserted that the value of the non-dyestuffs greatly exceeds the value of the dyes in these works at present, and will continue to do so in future. Heavy chemicals, such as ammonia and nitric acid, chlorine and caustic soda, and even sodium and cyanide, are much more important than the few dyestuffs used in the world.

Such re-arrangements as have been noted above have brought about certain amalgamations among Continental colour firms, whose power has been thereby increased not only in respect of capital, which is actually small, but owing to the co-operation and the pooling of technical experience that have followed. This co-operation is possible because the men who direct these undertakings have grown up with their plants and are scarcely influenced by external financial considerations. These amalgamations have created no boom on the Stock Exchange, and capital has not been watered by subdividing shares and then forcing the price of the new shares up to that of the old. Colour chemistry is no field for financiers; it requires long years of hard work. It is easy to manufacture any product on a very large scale, but it is another matter to sell it. I have seen plants which could easily supply the whole world with H-acid, naphthols, or aniline; they are shut down because there is no demand. The fundamental requirement of every sound colour industry is steady and serious development; disappointments are more frequent than agreeable surprises.

In this short paper it has not been possible to deal with the utilisation of by-products, to show how the industry is dependent on the cotton and wool crops, and to point out how essential it is that only university men should be employed as chemists in colour works; such topics must be left for another occasion.

THE ORGANIC CHEMICAL INDUSTRY AND NATIONAL SAFETY.

The members of the Dyestuff Group of the Association of British Chemical Manufacturers, which includes all the principal British dye-making firms, have had their attention drawn to a speech delivered by Mr. Lennox B. Lee in Manchester on September 22 at the annual meeting of the Calico Printers' Association (*cf.* J., 1921, 354 R), and feeling that the speech contains much which will misinform public opinion with regard to the British dyestuffs industry and to the action which Parliament has taken in prohibiting the importation of foreign dyestuffs except under licence, they desire to make the following statement:—

"It is not necessary to follow Mr. Lee through his economic argument, because the action of the Government in prohibiting the importation of dyestuffs is based on the all-important necessity of maintaining the safety and integrity of the British Empire. It is wrong, and dangerously wrong, to suggest on the basis of the general trade returns, that British chemical industry is sufficient for the needs of national defence. It is the undoubted lesson of the late war that the organic chemical industry, its established plant and its acquired skill, is absolutely fundamental in prosecuting warfare as it is understood to-day. In practice, the organic chemical industry is the intermediate-product and dyestuff industry; and it was for the purpose of preserving and developing this fundamental national asset that Parliament took the action of which Mr. Lee now disapproves. Great Britain did not fight alone in the war, nor has she alone learned its lessons, and it is important to note that the system of prohibition in relation to the dyestuff industry has been adopted in France, in Italy, and in the United States. It exists also in Australia and New Zealand, and is under the consideration of the Canadian Government. Mr. Lee would appear to suggest that the object of the Dyestuffs (Import Regulation) Act is to give assistance to those who are inefficient, but it will be obvious that the statesmen of four great powers do not make such a drastic change in ordinary peace-time fiscal policy unless they have in their minds some much more important reason than the support of the inefficient."

The members of the Group then refer to published statements (*Textile Mercury*, Dec. 11, 1920, pp. 603, 604), showing that Mr. Lee was not always of the opinion he now expresses. In the quotations given, the names of Mr. Gill, Mr. Allan, and Sir Milton Sharp are mentioned, and the members place on record their deep appreciation of the support they have received, and are still receiving, from these three gentlemen. "It is felt," the statement continues, "that such statements as those made by Mr. Lee are singularly dangerous, and it is desired once more to place before the public what is believed to be the real reason for the action of the Government."

MEETINGS OF OTHER SOCIETIES.

THE INSTITUTE OF METALS.

There was a very large attendance at the Autumn Meeting of the Institute of Metals, held in Birmingham from September 21 to 23, under the chairmanship of Sir George Goodwin. The large number of papers presented made it necessary to limit the discussions rather severely, this being a difficulty which is being increasingly felt at scientific congresses generally. The papers can be discussed subsequently by writing, but real disappointment is felt by many hearers when an interesting discussion is cut short by the necessity of proceeding with the programme. Some argument took place on Mr. R. T. Rolfe's paper on lead in gun-metal, it being doubted by some speakers whether lead could really improve the alloy, except by increasing soundness, and the President defended the Admiralty specification on the ground of the behaviour of the alloy at high temperatures. Another subject on which a difference of opinion appeared was that of the casting of brass, introduced by Mr. R. Genders. Whilst the suggested method of using a clay dozzle was approved by some, other speakers were opposed to the introduction of steelworks' methods into brass-casting on account of the differences in the solidification of steel and non-ferrous metals, and also questioned whether non-metallic inclusions were the cause of frequent defects in brass.

Mr. T. G. Bamford described measurements of the density of brasses, a subject on which remarkably little information exists. The alloys of copper with nickel and aluminium were discussed by Prof. A. A. Read and Mr. R. H. Greaves, and some unusual mechanical properties were shown to be characteristic of some of them. Two more papers dealt with the subject of cold-working, one by Dr. F Johnson giving an account of the behaviour of copper on rolling and annealing, and the other, by Messrs. W. E. Alkins and W. Cartwright, entering further into the question of wire-drawing, the alloy used in this case being a bronze low in tin. A curious anomaly in the change of density during drawing led to a theoretical discussion, and a possible explanation was advanced by Prof. Thompson. Mr. Genders described investigations into the causes of the characteristic defect of extruded brass rods, and in the course of the discussion two series of experiments with wax and plasticine were described, one being by Mr. Redding, and the other by the staff of the National Physical Laboratory. Members could not agree completely as to the interpretation of these models. Remarks from manufacturers were invited, but none was forthcoming, and the President deplored the fact that, although many manufacturers, both during and since the war, must have had experience of this defect, no one could be induced to contribute to the debate.

Exchange of information should be mutual, and it is to be hoped that experiences in works will be described before the publication of the volume containing the papers. It would be very unfortunate if the expressions of opinion on such subjects, which concern the whole non-ferrous industry, should be confined to the academic members and laboratory investigators only.

Mr. F. S. Tritton gave an account of the sources of error in the use of the scleroscope in testing hardness, and indicated how some of them may be overcome, whilst another paper from the National Physical Laboratory, by Dr. D. Hanson and Miss M. L. V. Gayler, excellently presented by the latter, described the influence of magnesium and silicon on aluminium. The photomicrographs in this paper were exceptionally good, and the results indicate the nature of the compound which, by its varying solubility in the solid state, is responsible for the ageing of duralumin. Mr. F. Adcock contributed a useful note on improved methods of electrolytic etching, which are particularly advantageous when dealing with cold-worked metals, and a note on electron (a light magnesium alloy) by Mr. S. Beckinsale had to be taken as read.

The meeting included an evening municipal reception and a garden party given by the local committee, as well as a visit to the University. Most interesting works visits were arranged, and mention should be made of the exhibition of specimens of metallurgical interest displayed at the Technical School, prominent among them being an interesting series illustrating the processes of corrosion, exhibited by Dr. Friend. An excursion to the historic districts of Warwickshire concluded the meeting.

THE FARADAY SOCIETY.

A meeting of the Faraday Society was held on September 28 in the hall of the Institution of Electrical Engineers, and attracted a crowded audience. The afternoon session was opened by Prof. J. Perrin, of Paris, who spoke in French, and gave a very lucid account of the radiation theory of chemical reactions. He explained how the law of mass action had been found to give a quite satisfactory account of chemical reactions between several molecules, but that it failed in the case of simple dissociations. A single molecule of phosphonium chloride would dissociate in a vacuum, although no question of collisions with other molecules could arise. The only source of energy capable of bringing about the reactions was the internal radiation in the system. The application of the idea of quanta to the problem and the derivation of the laws of Planck and Bohr from the theory and the empirical relation of Arrhenius were explained. Coloured flames, such as those of cyanogen and carbon monoxide, emit the characteristic radiations of reactions. Fluorescence is regarded as due to tautomeric change, transforming radiant energy. Certain criticisms of the theory were dealt with. In the catalysis of gaseous reactions by platinum, the density of radiation at the surface of the metal is very great. Radioactive changes in the nucleus follow essentially similar laws, but the exciting radiation in this case is of the ultra-X type, bearing much the same relation to X-rays that the latter bear to ordinary light. The interesting suggestion was made that potassium in living organisms might possibly be replaced by uranium, etc. in radio-actively equivalent quantity.

Prof. W. C. M. Lewis gave a short abstract of an exhaustive paper on the subject which had been circulated to members. He maintained the fundamental difference between thermal and photochemical changes, and gave an account of the theory of photocatalysis. Prof. F. A. Lindemann made some damaging criticisms of the theory as a whole. He doubted whether there was any real evidence for chemical change in cases where the number of possible collisions between molecules had been very greatly reduced. The formulæ given by the earlier speakers would require that an atom should absorb several quanta of different frequencies before any change took place, an improbable assumption. Prof. Lewis had explained the fact that many reactions were not sensibly accelerated by exposure to sunlight by the high absorption of the radiation by a thin outer layer of the liquid, so that throughout the bulk of the liquid the density of radiation was scarcely increased by the exposure. Prof. Lindemann showed that this was quite inadequate to account for the absence of acceleration, and that in any case it could be avoided by merely agitating the liquid. A possible means of overcoming Prof. Perrin's difficulty in regard to mass action in dissociations was suggested. Prof. E. C. C. Baly brought forward the view that an atom is characterised rather by a definite atomic quantum of energy than by a frequency, and that a change of state was marked by a definite frequency, all these frequencies being integral multiples of a definite unit, probably that of the hydrogen atom. This involves giving a physical significance to the Least Common Multiple, a proposal which is now under discussion. The speaker could see no essential difference between a thermal and a photochemical reaction, and described an interesting time effect in the reaction between gaseous hydrogen and chlorine. There is also a chemical difference in reactivity between ammonia in the gaseous state and ammonia which has been liquefied and again evaporated, although the latter has regained thermal equilibrium with its surroundings. This is explained by the existence of differing phases of a single molecule. Prof. S. Arrhenius, to whom the early work on this subject owes so much, made a few remarks on the general question, and then Dr. I. Langmuir intervened with an important criticism. He remarked that there were certain physical phenomena of such a kind that when the logarithm of one quantity was plotted against the reciprocal of the temperature, a straight line was obtained. The first quantity might be vapour pressure, reaction velocity, the rate at which a heated glass rod would elongate, the electrical conductivity of glass, or Wien's expression for monochromatic radiation. It was not justifiable to select two of these, and to say that radiation was the cause of chemical reactions. Actually, all these things had something in common, namely, the quantum. The quantity, $\beta\nu$, had the dimensions of energy, and this was the real explanation of the connexion.

At the evening session, Dr. Langmuir gave an abstract of his two printed papers on heterogeneous catalysis, and described experiments with surface films, which have so brilliantly illuminated such different subjects as gas reactions in contact with metal surfaces, and lubrication by means of oils. The formation of a monomolecular film, held in position by forces which are essentially chemical, formed the basis of explanation in each case, and the audience was struck by the ingenuity with which this conception was applied, and by the simplicity of the results. Dr. E. K. Rideal thought that when easily liquefiable gases were present, such as ethylene in contact with a carbon surface, layers of a greater thickness than one molecule might well be formed, and this would account for many peculiarities of contact action. A communication from Prof. Bone was read, calling attention to his own early work on the combustion of hydrocarbons and on contact combustion, in which some of the conclusions of the Langmuir theory were anticipated. Prof. Baly considered that an attached molecule, of oxygen, for instance, might form a complex deriving its energy from the platinum on which it rested. Finally, Dr. E. Edser described experiments with oil films which indicated that the attraction of molecules must extend to a greater distance than a molecular radius. He had been able to calculate the surface tension for many liquids, exclusive of mercury, from bulk properties of the liquid alone, such as compressibility, expansibility, etc. Dr. Langmuir briefly replied. The meetings were presided over in succession by Prof. A. W. Porter and Prof. F. G. Donnan.

THE CHEMICAL SOCIETY.

The syllabus of meetings for the session 1921-22 states that the number of ordinary scientific meetings has been increased, and that the titles of papers to be read will not in future be advertised in the daily Press. The following lectures will be given at the Institution of Mechanical Engineers: "The Genesis of Ores," by Prof. J. W. Gregory on December 8; "Artificial Disintegration of Elements," by Sir Ernest Rutherford on February 9, 1922; and "Chemical and Physiological Properties," by Dr. H. H. Dale. Informal meetings will be held on November 3, March 30, and May 18, and the Annual Meeting on March 30.

At the initial ordinary meeting held on October 6, Dr. M. O. Forster presiding, there were ten papers on the agenda, of which eight were read in abstract. Dr. S. Judd Lewis explained the construction of a new adjustable electrically-heated thermostat for all temperatures between 0° and 100° C. Mr. A. F. Dufton described laboratory experiments on the separation of benzene and toluene by distillation using different still-heads, including a head 1 metre long filled with hollow glass beads which had a thermal efficiency of 47 per cent. Mr. P. K. Dutt showed how he obtained a new azo-compound by the action of diazo-salt on *p*-toluenesulphonamide. Mr. A. Shimomura outlined briefly some work he had done with Prof. J. B. Cohen on the synthesis of optically-active organic compounds; and a paper by the late Dr. H. R. Le Sueur and Mr. C. C. Wood on the action of fused caustic potash on phenylglyceric acid was summarised by Mr. Wood. The effect of neutral salt action on the hydrolysis of ethyl formate was described by Mr. A. B. Manning.

PERSONALIA.

Sir William Pope has been awarded the "Grande Médaille" and Dr. F. G. Cottrell has been elected an honorary member of the Société de Chimie Industrielle.

Prof. J. Cavalier, Rector of the University of Toulouse, is to give a series of lectures on metallurgy in the United States, as exchange-professor.

The German Bunsen Society has awarded the Bunsen Medal to Prof. G. Tamman, director of the Institute for Physical Chemistry in the University of Göttingen.

Mr. F. W. Lewis, who has been associated with the firm of Messrs. A. Boake, Roberts and Co., Ltd., for the past 25 years, has been elected to the board of that company.

Prof. J. C. Philip, professor of physical chemistry at the Imperial College, South Kensington, was entertained at dinner on October 11 by his colleagues and students as an appreciation of his services in furthering the interests of the Royal College of Science during the past 21 years. An illuminated address and other gifts were presented to him by Sir William Tilden on behalf of the hosts.

Dr. W. Böttger, extra-ordinary professor of analytical chemistry in the University of Leipzig, has been offered the posts of director of the division of general chemistry at the State Station for Testing Materials at Berlin and professor of inorganic and analytical chemistry at the German Technical "Hochschule" at Prague.

Dr. F. Feist has been appointed to the chair of chemistry and chemical technology, Dr. P. Herrmann to the chair of pharmaceutical chemistry, Dr. O. Mumm to the chair of chemistry, and Prof. Skita to be director of the department of organic chemistry, in the University of Kiel. The chair of pharmaceutical chemistry in the University of Griefswald has been filled by the election of Dr. F. Lehmann, of Königsberg University.

The death is announced of Dr. Gottlieb Stein, aged 66 years, who was a well-known German authority on dyeing, printing and finishing, and the author of various publications on those subjects; also of Prof. Kirchner, formerly professor of agriculture and director of the Agricultural Institute in the University of Leipzig.

NEWS AND NOTES.

BRITISH INDIA.

First Forecast of the Sesamum Crop.—The total area under sesamum in British India is reported to be 1,543,000 acres, which compares with 1,553,000 acres at the same time last year. The chief producing areas are the United Provinces, Madras, Central Provinces, and Berar, which represent over 60 per cent. of the total area under sesamum. The weather at sowing time was generally favourable and the crop is reported to be good.—(*Ind. Tr. J.*, *Sept.* 1, 1921.)

The Indian Sugar Committee.—The report of the Indian Sugar Committee, which has recently been published, deals exhaustively with the sugar industry in each province, and points out that a very large percentage of the sugar content of the cane is lost owing to antiquated methods of production and inefficient milling. As a result the Indian output is now just over 1 ton per acre, compared with over 4 t. in Java and more than 4½ t. in Hawaii. The Committee considers that the institution of an Indian Sugar Board is essential to progress, and that such a board should consist primarily and mainly of officials, but should ultimately become non-official. The establishment of an Imperial Sugar Research Institute to control research work in the various provinces is also recommended. On the question of protecting the Indian sugar industry by a tariff, the conclusion is reached that the present tariff, together with the ocean and railway freights, should provide ample protection. It is pointed out that Mauritius is the only part of the Empire that would benefit by an Imperial preferential tariff on sugar imported into India.

The Utilisation of Bitterns.—Magnesium chloride is largely used in the textile industry as a deliquescent agent in sizing, and at the outbreak of war it became necessary for India to find some source other than Germany, hitherto the chief producer. Bulletin No. 2 of the Bombay Department of Industries (Pp. 14, price 4 annas) contains an account by A. J. Turner of the work done on the utilisation of bitterns as a source of magnesium chloride. Investigation showed that large quantities were available at the Government salt works in Kharaghoda, where the brines have the following percentage composition:—$NaCl$ 16%, $MgCl_2$ 4·60%, $CaCl_2$ 0·25%, Na_2SO_4 0·50%, $MgSO_4$ 0·82%, $CaCO_3$

0·02%, and $CaSO_4$ 0·67%. After several preliminary attempts the Pioneer Magnesia Works was established and the improvement of the process of manufacture was taken in hand, especially as regards economy of fuel consumption and the time required for concentrating the bitterns or mother liquors. It can now be said that the industrial production of magnesium chloride is established in India, and, when the utilisation of the by-products, chiefly bromine, magnesium sulphate, and sodium sulphate, has been worked out, Kharaghoda will probably become the centre of a flourishing industry which should more than meet Indian requirements.

AUSTRALIA.

Salt Lake in Queensland.—Very large quantities of salt are found in Lake Buchanan, 150 miles south-west of Pentland, which is 32 miles long by 8 broad at the widest part. In the dry season a deposit of high-grade salt is left which is 8 to 36 in. thick and covers an area of roughly 48 sq. miles. The salt is now being collected by scooping into large heaps in shallow water and then shovelling into perforated kerosene tins to drain. Given cheap carriage the deposit should be very valuable.

Australian Hardwoods as Paper-making Material.—The New South Wales Forestry Commission has rereceived an interim report on paper-making tests of pulp from various Australian hardwoods lately carried out at the Forest Products Laboratory, Perth. An official report states that although the research into the best methods of handling the various pulps has not yet advanced very far, the authorities have sufficient data available to demonstrate quite clearly that the pulps on which the experiments were made are suitable for many kinds of paper. Six pulps were tested for their paper-making qualities, both unbleached sheets and bleached sheets being produced from each pulp. The pulps tested were from mountain ash (Victoria), Blackbutt, spotted gum, mountain gum (N.S.W.), karri (W.A.), and silky oak (Queensland). Silky oak is the best of all timbers tested, but of the hardwoods, which alone occur in large quantities in the forests, mountain ash gives the best pulp wood and apparently also the best paper.—(*Ind. Austral., July* 7, 1921.)

CANADA.

The Explosives Industry in 1918.—Especial interest attaches to the report of the Dominion Bureau of Statistics on the Canadian explosives industry in 1918, as in that year production was on a scale far in excess of any previous years.

The total capital invested in the industry is estimated to have been $19,172,539, inclusive of $12,444,785 invested in land, buildings, machinery and tools. There were 11 manufacturing firms (5 in Ontario, 3 in British Columbia, and 3 in Quebec), and the number of wage-earners employed was 4708. The chief materials used were valued at $23,125,839, and included:—Sulphur 487 short tons; sodium nitrate 35,680 t.; mixed acids 23,250 t.; grain alcohol 2884 t.; charcoal 94 t.; sulphuric acid 52,918 t.; nitric acid 7487 t.; benzene 42 t.; caustic soda 55 t.; diphenylamine 36 t.; pyro 3529 t.; soda ash 167 t.; sodium sulphite 586 t.; oleum 26,458 t.; toluene 2528 t.; linters 6534 t.; and calcium chloride 29 t. The weight of explosives produced was 48,780 t. (including 10,837 t. of dynamite and 4332 of smokeless powder); other products included:—Acids, recovered and sold, 2197 t.; ether 53 t.; nitre cake 3161 t.; and sulphuric acid 2218 t. The value of the whole output was $41,477,828. Imports of materials used in the manufacture of explosives, matches, and fireworks amounted in value to $9,733,702, the chief items being:—Sodium nitrate 51,996 t.; sulphuric acid 5954 t.; caustic soda 6113 t.; sulphur, 97,062 t.; starch 1217 t.; and rosin 17,128 t. Imports of finished products were very low, but exports were valued at $272,912,776, and included cartridges $232,634,973, explosives and fulminates $40,108,383, and sulphuric acid $165,579 (5599 t.). Including the manufacture of fireworks and matches, the total capital invested in the Canadian explosives industry in 1918 was over 22 million dollars and the selling value of the finished products was 43 millions.

UNITED STATES.

Chemical Plant Manufacture.—At a meeting of representatives of the leading manufacturers of chemical plant equipment at the Chemists' Club, New York, on September 17, it was decided to form an Association of Chemical Plant Equipment Manufacturers. The object of this association is to further various interests of these manufacturers, which, it is believed, can be promoted more satisfactorily by action as a group rather than as individuals. The chairman of the organising committee is Mr. J. George Lehman, of the Bethlehem Foundry and Machine Company.

Electro-deposition of Nickel on Engraved Plates.—In a research on the production of plates suitable for engraving, Dr. W. Blum has found that the use of fluoride in nickel solutions increases the wearing quality of the printing surfaces. By using a current density slightly higher than that ordinarily employed, he obtained good deposits which, although slightly harder to polish, showed great resistance to abrasion. Nickel deposits produced in solutions containing fluorides have a finer structure and greater tensile strength than those produced in chloride solutions.

The Preservation of Timber.—Green lumber which cannot be kiln-dried is liable to attack by a fungus which produces blue stains. The subject has been investigated at the Forest Products Laboratory, and it has been found that antiseptic dips are efficacious, particularly warm solutions of sodium carbonate or bicarbonate. In wet weather an 8 per cent. solution of the carbonate or an 11 per cent. solution of the bicarbonate should be used, and the concentration can be decreased to 4 and 5 per cent, respectively, in dry weather. The timber should be treated immediately after sawing and then piled in such a way as to ensure ample ventilation.

The Potash Situation.—In a paper read before the Fertiliser Division of the American Chemical Society at the New York meeting, Mr. H. A. Huston discussed the potash situation from the standpoint of the relative quantities of soluble potash salts estimated by geologists to exist in the United States, France, and Germany, and the development of these resources in the different countries. The geologists estimate that for each ton of soluble potash salts in the United States there are 10 tons in France and 6000 tons in Germany. The estimated productive capacity of the existing potash properties in terms of pure potash (K_2O) is 80,000 short tons for the United States, 250,000 t. for France, and 3,850,000 t. for Germany. France has 13 completed shafts and 3 mills; Germany has 204 completed shafts and 17 mills. The mineral suitable for producing sulphate of potash is not found in France.

Antimony in 1919.—At the beginning of 1919 the Governments of the United States and Canada held more than 5200 short tons of antimony and there were also large stocks in private hands, so that the total supply was more than sufficient to last a further six months. Consequently prices fell, almost to pre-war level, mining practically ceased, and production was restricted to two small smelters (it practically ceased in November, 1918). The output of by-product antimonial lead in 1919 was

13,874 t., containing 1943 t. of antimony, and 4399 t. of the metal was recovered from old alloys, scrap, and dross. Of the imports, comprising metallic antimony 7159 t., together with smaller quantities shipped as ore, sulphide, oxides, etc., China supplied 55, Japan 22, Canada 16, Mexico 5, and England 0·6 per cent. The world's production of antimony reached its maximum in 1916 with 82,000 t.; in 1919 it was 11,850 t. At present the world's capacity to produce antimony far exceeds the normal demand and production will be limited as long as present prices continue. It appears that more uses are being found for the metal as the consumption in 1919 was somewhat greater than before the war.—(*U.S. Geol. Surv., June* 6, 1921.)

Asphalt and Related Bitumens in 1919.—The production of native asphalt and related bitumens in the United States in 1919 was 88,281 short tons, valued at $682,989, an increase of 47 per cent. in quantity and a decrease of 13 per cent. in value compared with 1918. In addition, 614,692 t. of asphalt manufactured from domestic petroleum and 674,876 t. from Mexican petroleum were sold. The value of exports of manufactured and unmanufactured asphalt was $1,710,848, and that of imports of native asphalt and bituminous rock $615,499. Trinidad and Tobago contributed 51,062 t. and Venezuela 47,309 t. of the total imports of 105,648 t., which also included 1673 t. of ozokerite and 14 t. of ichthyol and ichthyol substitutes. It is understood that in 1920 the Meadows Chemical Corporation, of New York City, began to distil an oil resembling ichthyol from asphaltic limestone quarried near Burnet, Texas, the oil being worked up at the company's plant in Durant, N.Y. Imports of ichthyol into the United States in recent years have been as follows (short tons):—1914, 30·7 t.; 1915, 12·46 t.; 1916, 58·37 t.; 1917, 29·2 t.; 1918, 32·88 t.; 1919, 15·49 t. The value of the ichthyol imported in 1919 was about the same as that imported in 1918.—(*U.S. Geol. Surv., July* 18, 1921.)

The Beet-Sugar Crop in 1920-21.—The total beet-sugar production in the United States in 1920–21 was 1,090,021 short tons, 363,570 t. more than in 1919–20, and the largest crop ever recorded. Sugar-beet was grown on 872,376 acres, the yield of beets was 7,999,221 t., or an average of 9·17 t. per acre (for beets actually worked), and an average of 13·63 per cent. of sugar was extracted, compared with 12·34 per cent. in the previous year (*cf.* J., 1921, 173 R).—(*Ind. Tr. J., Aug.* 25, 1921.)

Maple-Sugar Production.—Large quantities of maple sugar are produced in the United States, 99 per cent. of the output coming from the States of Maine, New Hampshire, Vermont, Massachusetts, Connecticut, New York, Pennsylvania, Maryland, W. Virginia, Ohio, Indiana, Michigan, and Wisconsin. The production of sugar and syrup since 1917 has been as follows:—

	Sugar. Long tons.	Syrup. Galls.
1917	4,838	4,286,100
1918	5,924	4,905,264
1919	4,539	3,854,488
1920	3,372	3,657,255
1921	2,273	2,583,500

The reduced output in 1921 is due to the unfavourable weather, the smaller number of trees tapped, and the lower average yield per tree.—(*Ind. Tr. J., Aug.* 4, 1921.)

FRANCE.

Potash Production in Alsace.—The production of the Alsatian potash mines in 1913 was 350,340 metric tons, equivalent to 56,000 t. K_2O. In 1919 the output was 464,607 t. (92,006 t. K_2O), and rose in 1920 to 1,061,191 t. (199,230 t. K_2O), consisting of:—Sylvine (12—16% K_2O), 664,019 t.; sylvine (20—22%), 335,820 t.; potassium chloride (50—60%), 61,352 t. Since March, 1921, grades of sylvine containing 30 and 40 per cent. K_2O have been produced.—(*Chem. Ind., July* 18, 1921.)

Industrial Notes.—*Metallurgy.*—During the first six months of 1921, the output of iron ore in France was 7,533,000 metric tons, inclusive of 4,098,000 t. from the Metz-Thionville area; in the same period of 1913, but excluding that area, the output was 5,840,000 t. The production of pig iron in the same periods was 1,745,000 t., and 2,618,000 t., respectively; the increase from 1,273,000 t. in 1920 is satisfactory, but the leeway that has still to be made up is apparent from the consideration that the output given for 1913 does not include that of Lorraine. A total of 1,528,000 t. of steel was produced during the half-year, as against 1,180,000 t. and 2,341,000 for the same period in 1920 and 1913, respectively. The outlook for the metallurgical industry is now more hopeful as merchants' stocks are depleted and orders have lately been increasing. The gradual exhaustion of the scrap ferrous metals left over from the war has stimulated the production and sale of pig iron. A new trust has been formed which includes La Société des Forges et Aciéries du Nord et de l'Est, Les Usines Métallurgiques de la Basse Loire, and the chief metallurgical companies in Lorraine.

Chemicals and Sugar.—There is a noticeable improvement in the demand for chemicals; prices of oils, fats, soaps, and resins are firm, and that of oil of turpentine has risen from 260—265 f. to 300—320 fr.

The sugar crop of 1920—21 was a remarkable one. Twelve new factories were erected—some to replace old ones—and the crop was handled by seventy-two. The total production was 306,464 metric tons of sugar, compared with 155,871 t. in the previous year. It is reported that the present year's production will not be so good, and that there may be a deficit despite the larger area under cultivation.

GENERAL.

Research in the Brewing Industry.—The scheme of research which has been initiated by the Institute of Brewing (*cf.* J., 1921, 32 R, 256 R) may now be described as fairly under way, particularly in regard to the study of the raw materials used in the industry. The experimental work on hops is being conducted in Kent at Wye, East Malling, Beltring, Chilham, and Horsmonden; and on September 2 a large party of hop-growers and members of the Institute paid a visit to East Malling and Beltring. Seedlings raised by Mr E. S. Salmon in the "Hop Nursery" at Wye College are being tested under large-scale conditions to ascertain their fruitfulness, aroma, resin content, and resistance to disease, and are being compared as regards yield, quality, etc. with commercial varieties grown under identical conditions. At the hop gardens of Messrs. Whitbread at Beltring, extensive experiments are being carried out in the kilns in order to determine:—(1) The effect of varying temperatures with constant air-current and of varying air-current with constant temperature, (2) the influence of the moisture content of the hops, (3) the effect of burning varying amounts of sulphur, (4) the effect of products of combustion of open fires, and to study (5) the use of dried air, (6) variation of height of hair above fire, and (7) the influence of the weather.

The Occurrence of Platinum in Cornwall.—With reference to the recent suggestion of Dr. R. H. Rastall that platinum might be found in the alluvial gravels of the serpentine area in the Lizard district of Cornwall (cf. J., 1921, 256 R), samples of the river gravels have recently been tested, and it was found that a very small amount of platinum was present in the material collected from one locality. A more thorough examination of the area was then made, but the results were unsatisfactory. It is, therefore, concluded that platinum undoubtedly occurs in the Lizard district associated with ultrabasic rocks, but not in quantities of economic importance. This was to be expected as the amount of real alluvial material in the district is small.—(*Min. Mag., Sept.*, 1921.)

Disposal of Radium from Czechoslovakia.—The Czechoslovak Legation in London has issued a communication explaining the contract which has been entered into by the Czechoslovak Government, as the owners of the pitchblende deposits in Joachimsthal, and the Imperial and Foreign Corporation, Ltd., of London. The Government and the Corporation hold equal interests in the newly-formed Radium Corporation of Czechoslovakia, which is acquiring the loan for a period of 15 years of the radium output of the mines in Joachimsthal, less a certain portion which will be reserved for therapeutic and scientific uses. The Czechoslovak State will retain the property rights of the radium and will continue to work the deposits. Prof. F. Soddy has recently brought to this country on behalf of the Corporation preparations containing 2 grams of radium element from Czechoslovakia, of which the estimated value is said to be £70,000.

Barium Minerals, 1913—1919. (Imperial Mineral Resources Bureau and H.M. Stationery Office. 26 pp. Price 9d. net.)—A short survey of the deposits in the United Kingdom and abroad are given in this pamphlet, together with a description of the chief minerals, their uses and preparation. Statistics show that in 1913 barium minerals amounting to 50,000 tons were produced in this country at an average price of 16s. 10d. per t., rising to 60,000 t. in 1919 at an average price of 66s. 1d. Imports into the United Kingdom were, for the same two years, 54,600 t. and 20,400 t., respectively, at average values of 55s. and 237s. It would have been interesting if the Bureau could have accompanied these statistics with an explanation of the disparity in the values between the imported and home-produced mineral. Was that imported of higher value by reason of a naturally higher-grade raw material, or because it had been chemically treated and ground to produce a more marketable product? Of the 54,600 t. imported in 1913, 40,300 t. was of German origin, and in 1919 importation from Germany was already resumed with nearly 800 t. for the year.

New Chemical Factory in Indo-China.—A large chemical factory has been erected at Haiphong, Indo-China, by the Société Industrielle de Chimie d'Extrême Orient for the manufacture of electrolytic caustic soda, chlorine, hydrogen, and chloride of lime. The output of soda is to be 3 tons per day, which will meet the requirements of the local paper and glass factories, etc.; the remaining products will be sold locally for bleaching textiles, hydrogenation of oils, etc. Sulphuric acid and calcium carbide are also to be manufactured, as well as fertilisers, which at present are imported in large quantities.—(*Oil, Paint and Drug Rep., July* 11, 1921.)

Mining Industry in Trinidad During 1920.—*Petroleum.*—The annual Report of the Inspector of Mines for 1920 states that improved deliveries of drilling equipment and machinery enabled a number of new oil companies to commence operations, and several have started drilling in areas from which oil has not yet been extracted. At the close of the year, 22 companies were engaged in the winning of oil as against 13 at the end of the year 1913. The quantity of oil produced has increased from 64,436,632 galls. in 1919 to 72,905,947 galls. in 1920, but the export of crude oil and its products decreased by 13 million galls. to 36 million galls.; there were, however, considerable stocks of oil still awaiting export at the close of the year. Shipments of oil fuel to the Admiralty constitute the largest part of the oil exported from the Colony, and the lighter products are mostly exported to private firms.

Manjak.—The Trinidad Tarouba Oil Development Co., the only company which is operating in this industry, continued to work the Vistabella Mine, at San Fernando, and produced 134 tons of manjak during 1920.

The Enrichment of Low-grade Basic Slag.—A summary of the interim report of the committee appointed in July, 1920, "to consider the development and improvement of the manufacture of basic slag and the extension of its use" is published in the September issue of the *Journal of the Ministry of Agriculture.* Of the 701,393 tons of basic slag containing 13·4 million units of phosphate which were produced in Great Britain during the year ended September 30, 1920, about 560,000 t. contained over 15·5 per cent. phosphate of which only 46,000 t. was of the basic Bessemer type (above 33 per cent. phosphate). As before the war 260,000 t. of high-grade slag containing 9,880,000 units was produced annually, the present output would appear to be adequate. Competent authorities believe, however, that farmers should use far more basic slag than they do, and Sir T. Middleton is of the opinion that an amount equivalent to 2½ times the present output should be used. Since the output of slag depends on the output of steel, the committee examined the possibility of increasing the production of phosphorus by some additional method. Experiments were made on the effect of adding mineral phosphate to slag in the ladle, but it was found that the mineral was changed too slightly to justify the process.

The committee is still investigating (a) the utilisation of iron ore containing more phosphorus or addition of phosphates in the blast furnace, in order to obtain a slag richer in phosphorus; this could only be done if the price of the slag would cover the increase in the cost of producing steel; (b) the re-introduction into the blast furnace of the two lowest grades of slag (containing up to 11, and 11—15·5 per cent. phosphate, respectively); this would not alter the total phosphate content but would increase the proportion of higher to lower grades. As it may be found impracticable to improve the quality or quantity of basic slag, the committee has initiated experiments to ascertain the agricultural value of present-day slags in comparison with the basic Bessemer slags and mineral phosphates. Some information has already been obtained, and further experiments have been arranged at Rothamsted to elucidate the following points:—(1) Whether soluble and insoluble open-hearth slags differ in agricultural value; if so, whether a better method of evaluation than the citric-acid test can be devised. (2) If open-hearth slags are inferior to Bessemer slags when applied in quantities containing equal amounts of phosphorus. (3) Whether finely-ground mineral phosphates differ greatly in value from basic slag. (4) If the manurial effect of basic slag depends entirely on its phosphate content, or whether other constituents (manganese, etc.) are beneficial. Pot experiments under way at Rothamsted do not indicate that manganese is valuable.

Potash Mining in Spain.—It is reported that the boring at Cardona, carried out by the Spanish Government in conjunction with the German Potash Syndicate, has reached a depth of 3900 ft. without meeting with even traces of potash, and that as no results have been obtained boring is to be discontinued. It is also announced that, for similar reasons, the American syndicate which acquired part of the Solvay concessions in Spain and sank a shaft at a cost of 2 million pesetas (peseta = 9½d. at par) has cancelled its contract and abandoned the shaft.—(*Oil, Paint and Drug Rep., Aug.* 15, 1921.)

Camphor Production in China.—According to a Chinese customs report the export of camphor from China has increased from 316,854 lb. in 1916 to 3,998,600 lb. in 1920, whereas the output of Formosan camphor has decreased from 6,968,835 lb. in 1910 to 2,857,114 lb. in 1919. The crude Chinese system of distillation, however, cannot compete with the modern methods employed in Formosa and it is feared that the Chinese practice of cutting down the trees without planting new ones may prove fatal to the industry unless re-afforestation is begun. —(*Oil, Paint and Drug Rep., Aug.* 8, 1921.)

Petroleum Development in Ecuador.—The Government of Ecuador has given permission to an American company to exploit the petroleum deposits in the Province of El Oriente for a period of 34 years. The company is under obligation to spend £5,000,000 and to construct three good roads to the oilfield.—(*U.S. Com. Rep., July* 6, 1921.)

The Hull Chemical and Engineering Society has issued its syllabus of meetings to be held during the session 1921–22. The Society, of which Mr. A. R. Tankard, F.I.C., is president, has approximately 200 members who are connected with the chemical and engineering professions. The first meeting of the session is to be held on October 18, when Mr. F. Grover will read a paper on "Wrapping Machinery."

REPORTS.

Report on the Industrial and Economic Situation in Czechoslovakia, Dated June, 1921. *By* R. H. B. Lockhart, *Commercial Secretary to H.M. Legation, Prague. Department of Overseas Trade. Pp.* 44. *London: H.M. Stationery Office.* 1921. *Price* 1s. 6*d.*

Czechoslovakia covers an area of over 140,000 sq. km. and comprises Bohemia, Moravia, Silesia, Slovakia, and the Ruthene Territory. Both as regards natural resources and industrial development it is one of the richest countries in Europe, especially as about 80 per cent. of the industry of the Austrian Empire passed to Czechoslovakia under the Peace Treaty. There are vast reserves of timber; agriculture, devoted mainly to the production of crops destined for the sugar, malt, starch, and alcohol industries, is in a flourishing condition; and there are valuable mineral resources which have not yet been fully developed, notably in Slovakia. The coal mines formerly supplied a large part of the requirements of the Austrian Empire but the production, 11 million t. hard coal and 20 million t. brown coal in 1920, now falls short of requirements by about 20 per cent. Radium, gold, silver, iron, graphite, and lead are all mined, oil is found in Slovakia, Bohemia has rich deposits of clay, kaolin, and sand, and the whole country is unusually rich in mineral and thermal springs. The productive capacity of the country exceeds home requirements by 65—70 per cent., as the protected Austrian market has been lost. Export is therefore imperative, but owing to the low purchasing power of most of the adjacent states new markets have to be found. At present many of the factories are closed down and the others are mostly working short time. The sugar industry is the most important agricultural industry (*cf.* J., 1921, 331 R), followed by alcohol, which is produced at over 1000 distilleries. Karlsbad is the centre of the porcelain industry, which produces largely for export and is now working at about 30 per cent. of its capacity. The world-famous glass industry of north and north-western Bohemia employs roughly 100,000 workers and also produces mainly for export. As a rule 90 per cent. of the output of window glass is exported, but French and Belgian competition and restricted foreign markets have made the outlook unpromising; there is, however, a fairly good demand for crystal glass. Aussig is the chief centre of the flourishing chemical industry, the main products of which are fertilisers, glue, ceramic colours, pharmaceutical products, and explosives. During the past two years lack of fuel and transport difficulties have prevented the iron and steel industry from working at full capacity. Although the fuel shortage has now been overcome, high freights and costs generally are making it increasingly difficult for Czechoslovak iron and steel to compete in the world's markets, especially in Germany. Apart from "luxury" articles, Czechoslovakia offers little scope for British goods as many of the staple commodities exported from Great Britain are already manufactured in the country. There is, however, a steady demand for raw and semi-raw materials, a fact which British firms do not appear to have recognised, as few firms have yet attempted to establish direct relations. It is pointed out that under present conditions satisfactory results will only be obtained by firms that send out their own representatives. The goods most in demand include animal and vegetable oils and fats, rubber, various ores and metals, wax, pharmaceutical products, fertilisers, woods for dyeing and tanning, and aniline oil. In 1920 Great Britain supplied 0·82 per cent. of the imports, 3,904,168 metric tons, and took 0·38 per cent. of the total exports, 6,902,221 t. (*cf.* J., 1921, 91 R).

Report of the Government Chemist upon the Work of the Government Laboratory for the Year ended March 31, 1921. *With Appendices. Pp.* 36. *London: H.M. Stationery Office.* 1921. [*Cmd.* 1490. 3*d.*]

The number of samples examined at the Government Laboratory and outpost chemical stations during 1920-21 was 308,675, or 60,223 fewer than in the preceding year, but the number tested in the Central Laboratory was 5265 higher at 204,653. There were notable increases in the number of samples of beer (for detection of dilution), of spirituous preparations exported, tea, and in the number of determinations of marine salinities for the Fisheries Department and the International Council for the Exploration of the Sea. To avoid delay in the examination of imports and exports, chemical stations have been established at the chief seaports of the United Kingdom. A total of 28,167 samples of beer was examined mainly for original gravity prior to fermentation, and 6608 samples of worts drawn locally were submitted as a check on the assessment of beer duty. The number of samples of beer which were rejected as sour rose from 770 to 1924, but only 34 cases of dilution were detected; overdeclaration was found in less than 1 per cent. of the 7366 samples examined under claims for drawback on exportation. Forty out of 1258 samples of beer and brewing materials tested for arsenic were found to contain it in excess of the legal limit, but with malt and sugar there were only two cases out of 692 examined.

Analyses were made of 395 samples of liquids obtained in the manufacture of spirits, 12 samples suspected of being illicitly distilled, 2244 of British compounded spirits for export, and 7772 of imported spirits and spirituous preparations. Of 733 samples of wood naphtha and mineral naphtha submitted for approval as denaturants only 13 were rejected as unsuitable. Claims for rebate on alcohol used in medicinal preparations or for permission to use duty-free alcohol in manufactures, tuition and research amounted to 1843. The number of wine samples tested was 71,159.

Of sugar, including molasses, syrups and articles containing sugar or other sweetening matter, 32,332 samples were examined, as well as 343 samples of glucose. The presence of saccharin was sought in 274 samples of imported materials, 192 samples of saccharin products were drawn to assess the drawback payable on export, and 325 samples of saccharin and of materials used in its manufacture were examined for assessment of duty.

Twenty-one samples of tobacco suspected of containing prohibited ingredients were examined and eight of these contained added sweetening matter. Essential oils are allowed to be used for flavouring, and 5 out of 19 samples submitted were condemned. Acetic acid is the only permissible preservative, and 6 samples of other preservatives were disapproved.

The number of samples of tea examined rose from 16,562 to 32,176, owing to the increase in the shipment of dust and of material that had laid long in storage. Grass seeds were found in a number of cases and 6979 packages were condemned as adulterated (in most cases accidentally); 3664 packages were declared unfit for human consumption. Rejected tea is allowed duty-free, if used for making caffeine, but it has to be denatured, and asafoetida or lime is usually employed, the former being used whenever possible. Samples of tea examined in this connexion numbered 749.

Considerable attention has been paid to the presence in chocolate of fats other than cacao butter and a new method has been worked out for estimating the actual percentage of the cacaobutter substitute used (*cf.* J., 1921, 518 A).

Ninety samples of imported colours, inks, perfumes and other goods were analysed for synthetic dyes or intermediate products of which the importation is prohibited except under licence.

None of the 67 samples of imported matches was found to contain white phosphorus.

Many samples of imported and home-made dairy produce and margarine were analysed for the Ministry of Agriculture. Only 19 of 1100 samples of margarine were found to contain more than 16 per cent. of water. None of them contained an excess of butter, and the simulation of the butter flavour is now generally obtained by other means.

Polluted effluents from milk and cheese factories and from suction-gas plants, using wood fuel, appear to be increasing. The pollution caused by road-drainage and tars is regarded as of extreme importance. Much information has been obtained concerning the proportions of toxic constituents in tar extracts and washings, and full details of methods used in their detection and estimation will be published shortly.

The miscellaneous work of the Laboratory included, *inter alia*, the investigation of the manurial value of exhausted raisins. They were found to contain: organic matter 23·51 and 17·48%, nitrogen 0·48 and 0·59%, phosphate 0·38 and 0·47%, potash 0·96 and 1·40%, and were adjudged to be equal in fertilising power to farmyard manure. Other investigations undertaken by the Laboratory were the detection of china clay used for adulterating feeding stuffs, the composition of oysters, the disintegrating effect of certain inks on rubber stamps, the use of certain arsenical preparations as wood preservatives, the suitability of certain paints and varnishes for protecting metal and wood from industrial fumes, etc.

Two hundred and three samples of potash salts from Germany were analysed and the results often differed widely from those supplied with the consignment, but not—in the few cases referred—from those obtained by referees in a neutral country.

The report concludes with lists of scientific papers published during the year and of the many problems investigated while Sir James Dobbie was head of the Department.

OFFICIAL TRADE INTELLIGENCE.

(*From the Board of Trade Journal for September* 29 *and October* 6.)

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W. 1, from firms, agents or individuals who desire to represent U.K. manufacturers or exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department and quoting the specific reference number.

Locality of firm or agent.	Materials.	Reference number.
Canada	Chamois and hat leather, glue ..	294
,, ...	Laboratory supplies	*
South Africa ..	Carbide, Yorkshire iron, galvanised corrugated iron	296
France	Chemical and medical products..	300
Latvia	Axle oil, cylinder oils (tender for)	4325/F.R./P.N.
Rumania	Rubber goods	303
Spain	Weed-killer..	286
Switzerland ..	Chemicals for the soap, paper, dye, printing, bleaching, and tanning industries	288
United States ..	Heavy chemicals, non-ferrous metals	291
,, ...	Fluorspar	306
,, ..	China, glassware	307
,, ..	Gauge glasses, stoneware, tiles ..	310
Dominican Republic	China, porcelain	292

* The Canadian Government Trade Commissioner, 73, Basinghall Street, London, E.C. 2.

TARIFF, CUSTOMS, EXCISE.

Belgium.—A copy of the Decree regulating the import, export, manufacture and sale of narcotics may be seen at the Department.

British Honduras.—As from August 23 the *ad valorem* duty under the general tariff has been increased to 20 per cent., but the corresponding duty under the British preferential tariff is, in most cases, 10 per cent. The preference accorded to British goods is thereby increased by 5 per cent.

The export duty on coconuts has been reduced to $1 per 1000.

Bulgaria.—Revised export duties are payable on raw skins, edible fats, sumac, kaolin, spirit, opium, rose oil, charcoal, bones, horns, certain metal wastes, etc.

The surcharge on customs duties when paid in paper currency has been increased to 1200 per cent.

Czechoslovakia.—Import licences are no longer required for cacao beans, raw hides and skins, and animal wax.

Export licences are no longer required for pharmaceutical products, certain vegetable fibres, paper, leather, glass and glassware (with some exceptions), earthenware (except tiles and porcelain), common metals (except iron), candles, soap, and chemicals (with some exceptions).

Iceland.—As from January 1, 1922, the import of alcohol and spirits containing more than 2¼ per cent. of alcohol will be prohibited except when imported through the Government.

Mexico.—Import duties have been reduced on lard and rubber tyres, and the export duty on henequen has been reduced by 2 centavos per kg.

Netherlands.—Recent customs decisions affect solutions of rubber, isobutyl alcohol, fruit flavourings, ceramic tiles, and strip iron.

New Zealand.—The regulations affecting the methods of labelling of terpeneless essence of lemon, vanilla essence, and vanilla substitutes have been amended. Hop preparations may now be imported.

Nigeria.—Amended customs duties affect, *inter alia*, earthenware, lamp oils, fuel oils, petrol, kola nuts, lead, matches, salt, soap, spirits, and perfumery.

Norway.—Certificates of origin are required to secure the benefits of the minimum tariff for spirits (except whisky), iron oxide, kitchen salt, cork, mercury, Malaga red, olive oil, sulphur, and cacao beans.

Nyasaland.—It is proposed to revise the customs duties and to levy an *ad valorem* tax of 15 per cent. on nearly all goods.

Panama.—The export duty on coconuts has been reduced to 1 balboa per 1000.

Poland.—Among the articles the import of which is still prohibited are sugar, spirits, certain wares of glass, china and pottery, perfumery, and fireworks.

All goods except petroleum and petroleum products are free of export duty.

Southern Rhodesia.—A copy of the current customs tariff may be seen at the Department.

Straits Settlements.—The customs duties on alcoholic beverages have been revised.

Switzerland.—Colours, varnishes and lacquer varnishes falling under tariff Nos. 1107—1111 and 1113 are subject to the alcohol-monopoly tax at the rate of 10 fr. per 100 kg. as from August 1.

All goods except scrap iron, gold, silver, and platinum may now be exported under general licence.

Import licence is required as from September 19 for fibrous materials for the manufacture of paper.

Turkey.—As from September 13 import duties at the rate of 11 per cent. *ad valorem* have been levied on all goods.

The pre-war rates of excise duty are now applicable to alcoholic beverages.

COMPANY NEWS.

MAGADI SODA CO., LTD.

At the tenth ordinary general meeting held in London on September 26, Mr. S. Samuel, chairman, said that the debit balance was £357,058 at December 31 last, inclusive of £159,327 for the year 1920, of which £49,342 was provision for depreciation (issued capital £1,312,043; debentures £499,950). The year had been marked by many disappointments in regard to production and shipments, and the War Office had definitely refused to pay compensation for the use of the Magadi railway and water-supply during the war. The pontoon excavation had not been the immediate success they had anticipated; the past season had been exceptionally dry so that the pontoon could not be launched, and they had been compelled to excavate the soda by manual labour. A bucket-dredger had been shipped out and was now being erected for use before the end of the year. But the business was not so hopeless as it appeared, for they were now actually producing 1000 tons per week of the finest quality of soda ash, and they were shipping it and selling it as fast as it could be delivered to the port of Kilindini. Further, they expected to be producing 5000 t. a month with one calciner very shortly and when the second calciner was in operation, before the end of the year, they hoped, the production would be at least 8000 t. per month; when this quantity was exceeded the business would be on a paying basis. Eventually it was hoped to produce 140,000 t. a year with the present machinery. The company had no money at all, but he believed so strongly in its future that he had personally guaranteed the overdraft at the bank; later on there should be no difficulty in raising fresh capital.

TRADE NOTES.

BRITISH.

Leeward Islands in 1919-20.—The Leeward Islands enjoyed a favourable year in 1919-20, the value of the exports, in particular, showing a large increase. In Antigua the area under sugar-cane was extended and progress was made in the control of the stainer pest of cotton. Among the exports from Antigua were:—Sugar, molasses, and syrup £314,562, cotton £16,362, hides and skins £1782, green limes £240, and lime juice £1079. Good prices were obtained for the staple products of St. Kitts and Nevis, viz., sugar and cotton, the exports including sugar and syrup (calculated as Muscovado) 11,015 t. and cotton lint 227 t. Exportation of coconuts from Dominica increased from 89,676 nuts in 1918 to 492,426 nuts in 1920, and exports of cacao from 212 to 369 t. Lime products exported from Dominica in 1919 were valued at £196,401 and comprised:—Lime juice, concentrated, 166,718 galls., raw juice 298,312 galls.; citrate of lime 339 t.; green limes 21,361 barrels (capacity of a barrel=4·55 cb. ft.); essential oil of limes 30·3 t.; otto of limes 7·6 t. The increase in exports from Montserrat was due to the good cotton crop, the exports being 193 t. lint and 433 t. cotton seed. Other agricultural industries in Montserrat are comparatively unimportant, but 96,851 galls. of raw lime juice, worth £15,587, was exported, together with concentrated lime juice, citrate of lime, and fresh limes valued at £1887. Only 58 t. (£844) of muscovado sugar was exported; there is a small but growing bay-oil industry; and the export of papaine was 1970 lb., valued at £1663. Cotton is the chief crop of the Virgin Islands.—(*Col. Rep.-Ann.*, No. 1074, 1921.)

FOREIGN.

Caustic Soda in Japan.—Before the war the annual demand for caustic soda in Japan was about 11,000 long tons, of which two-thirds was imported, mainly from the United Kingdom. During hostilities the United States became the chief source of imported caustic soda, but when the export from that country was prohibited in 1917 and 1918, the Japanese industry began to develop, the production rising from 6631 t. in 1916 to 14,013 t. in 1919. Owing to speculative purchasing from the United States in 1919, stocks accumulated rapidly, and at the beginning of 1920 prices began to fall. Since March of this year imports have been steadily decreasing, and the Japanese have curtailed production, so that equilibrium between supply and demand should be gradually restored. Imports of caustic soda from Great Britain were 944 t. in 1914, 31 t. in 1918, and 607 t. in 1919, and from the United States 80 t. in 1914, 159 t. in 1917, 516 t. in 1918, and 20,742 t. in 1920.—(*Ch. of Comm. J., Sept.* 9, 1921.)

Germany's Foreign Chemical Trade in 1920.—The exports and imports of chemicals from and into Germany during 1920 were as follows:—

	Exports. Metric tons.	Exports. Value in 1000 mk.	Imports. Metric tons.
Chemical raw materials, acids, salts, etc. ..	2,502,134·3 ..	4,241,208 ..	153,816·4
Dyes and dyestuffs ..	101,541·9 ..	3,682,683 ..	11,495·1
Varnish, lacquer, etc...	2,533·7 ..	45,996 ..	785·8
Ethers, alcohols, ethereal oils, synthetic perfumes, etc. ..	2,778·5 ..	217,608 ..	8,124·8
Fertilisers	6,473·0 ..	4,810 ..	67,997·3
Explosives, powders, etc.	4,321.9 ..	136,054 ..	5,195·1
Chemical and pharmaceutical products, other	12,677·8 ..	629,763 ..	18,221·9
Total	2,632,461·1 ..	8,958,122 ..	265,636·4

The importation of fertilisers rose from an average of 30,000 t. per month from January to September to 85,000 t. in October and 184,000 t. in December. —(*Chem. Ind., Aug.* 15, 1921.)

REVIEWS.

A Dictionary of British Scientific Instruments. *Issued by the British Optical Instrument Manufacturers' Association. Pp. xii. + 335. (London: Constable and Co., Ltd.* 1921.) *Price* 21*s. net.*

The reviewer is acquainted with no volume more unsatisfactory than the present one within the ambit of English scientific literature. He is heartily in agreement with those responsible for the issue of the volume in their belief that "a concise definition of each instrument, together with illustrations of the most important types, will be of real service to scientific men and the industry." How far does the volume go in the direction of providing such real service?

The book can be roughly divided into three sections. Opening with an altogether extraneous general view from above the National Physical Laboratory, and three illustrations of operations carried out thereat, perfectly unintelligible in the absence of any accompanying letterpress, the remainder of this section is devoted to short descriptions of "The British Optical Instrument Company," "Navigating Instruments," "The Royal Meteorological Society," "British Optical Glass," and "The Royal Observatory, Greenwich." The various matters are to a large extent treated historically, and some at least do not appear to have been written specifically for the present volume. That on "British Optical Glass" is, in the writer's opinion, the worst. Such common-place terms as "dispersive power" are wrongly defined, and an altogether wrong idea is conveyed of the production of achromatic images (p. 22). On pp. 28, 29 reference is made to three illustrations which are not given—an inversion of the practice already referred to.

The second section may be regarded as the dictionary proper. Its value can be judged from a consideration of a few examples of instruments upon which information was sought, *et hoc genus omne*. Some instruments, such as "astronomical clock" and "Cambridge flow recorder," are entirely undefined. Sometimes, when given, the definitions are of equal value. Thus:—"Bone and Wheeler's gas analysis apparatus" is "defined" as "for gas analysis purposes," "arsenic apparatus" as "used in the preparation and testing of arsenic," and an "autoclave" as "a vessel under steam pressure, for sterilising and other purposes; with a gauge for recording atmospheric pressure and temperature." Under "laboratory fittings" and "laboratory glassware" we find the "definition" "British make." Another very common type of definition is what may be called the "cross-reference definition." Thus, looking up "C.S.I. air-speed indicator," we find "A speed instrument for aeroplanes. See speedometer"; under "Speedometer" we read "See speed-recorder," and thereunder we find "an instrument for recording the speed of a motor car, etc." For a definition of the "Abbe Refractometer" we are referred to "refractometer," and we read, "Refractometer, Abbe, for liquids." Gas-works operations appear to be very restricted, as "Gas-works thermometers" are described as being of "two standard types, ranges 30°—160° F. and 70°—240° F. The attempt made to supply information as to where the various instruments may be obtained is frequently of little value.

The third section of the volume consists of illustrations of some of the various instruments "defined" in the second section. There is no accompanying letterpress. Most of the illustrations are taken from trade circulars, and many contain reference letters to the several parts (*e.g.*, pp. 202, 203, 212, etc.). There are three illustrations of a case of drawing instruments, and two full-page illustrations of spectacles and eye-glasses, the latter being referred to as of the folding pattern, of which pattern at least three pairs are not! The gold-leaf electroscope illustrated on p. 235 is shown tilted through a right-angle from its working position. The megaphone illustrated on p. 269 is probably the *chef-d'œuvre* in this section.

To sum up, a dictionary of scientific instruments is eminently desirable, but it must be conceived on very much more generous and accurate lines than the present volume if it is to fulfil its function. British scientific instruments derive, as stated in the preface, from the labours of those mighty geniuses, "Newton, Brewster, Airey, Dollond, Rayleigh, and Maxwell," that master of geometric design. There were others, and giants there are in the land to-day. Among the members of the Association responsible for the present volume we note some, at least, whose scientific instruments stand first amongst the similar products of the world. Let them ensure that their literary output is of a similar high standard, and not unworthy of their products and the high traditions of the British Scientific Instrument Industry.

J. S. G. Thomas.

Applied Colloid Chemistry: General Theory. *By* Wilder D. Bancroft. *International Chemical Series, edited by* H. P. Talbot. *Pp. viii.+345. (New York and London: McGraw-Hill Book Co., Inc.* 1921.) *Price* 18*s. net.*

This is a very interesting book and one which will be very valuable to practical chemists. It is packed with information, and the author's liking for facts and concrete realities is everywhere apparent. He makes a very sparing use of mathematical formulæ and discussions, and is not anxious to enter on any elaborate theorising or great generality of theoretical treatment. Nevertheless, most of the important points of theory are dealt with. The scope of the book will be evident from the following list of chapter headings:—I. Adsorption of Gas or Vapour by Solid. II. Adsorption of Vapour by Liquid, and of Liquid and Solid by Solid and Liquid. III. Adsorption from Solution. IV. Surface Tension—Brownian Movements. V. Coalescence. VI. Preparation of Colloidal Solutions. VII. Properties of Colloidal Solutions. VIII. Jellies and Gelatinous Precipitates. IX. Emulsions and Foams. X. Non-aqueous Colloidal Solutions. XI. Fog and Smoke. XII. Gases and Solids in Solids. XIII. Thickness of Surface Films. As will be seen from this list, many important matters are dealt with which have not hitherto been included in works on colloid chemistry. This is particularly evident in Chapters II., V., IX., and XI.

The book is very suggestive, as the author does not hesitate to state where reputed facts or explanations are doubtful or conflicting. The author's wide reading and knowledge make the book remarkable in the surprisingly wide range of subjects discussed. But the book is no mere compilation, as those readers will know who are familiar with the numerous researches on emulsions, colloids, adsorption, etc. which have appeared from Prof. Bancroft's laboratory at Cornell University. It can be warmly recommended to all those who desire a compact and concisely written account of the main facts and results of colloid chemistry. In characteristic fashion, the author gives in the Introduction a list of those who ought to study this subject. The passage is worth reproducing:—

"At first sight colloid chemistry may not seem to be an important branch of chemistry, either theoretically or technically; but this opinion changes when we consider that a knowledge of colloid chemistry is essential to anybody who really wishes to understand about: cement, bricks, pottery, porcelain, glass, enamels; oils, greases, soaps, candles; glue, starch, and adhesives; paints, varnishes, lacquers; rubber, celluloid, and other plastics; leather, paper, textiles; filaments, casts, pencils, and crayons; inks; roads, foundry cores, coke, asphalt; graphites, patines; zinc, phosphorus, sodium, and aluminium; contact sulphuric acid, hardened oils, etc.; beer, ale, and wine; cream, butter, cheese, and casein products; cooking, washing, dyeing, printing; ore flotation, water purification, sewage disposal; smoke prevention; photography; wireless telegraphy; illuminants; comets; pharmacy; physiology. In other words, colloid chemistry is the chemistry of everyday life."

F. G. Donnan.

A Text Book of Inorganic Chemistry. Vol. IX., Pt. II. Iron and its Compounds. *By* J. Newton Friend. *Pp. xxv.*+265. (*London: Charles Griffin and Co., Ltd.* 1921.) *Price* 18s. *net.*

This volume is a further instalment in the series edited by Dr. J. Newton Friend, and it is written by Dr. Friend himself. In style it is similar to the volumes already published; it is well and clearly printed, and deals with the subject adequately. The references to literature are copious and well selected, and the book should enhance Dr. Friend's reputation and prove of value to all who are interested in the chemistry of iron.

The work as a whole is so well done that little detailed criticism is necessary, but a few minor points may be noted. Stannous chloride is twice recommended for reducing ferric salts before volumetric determination, but no mention is made of the necessity for removing excess of the reagent before titration. Calcium ferrite is described, and the only reference given to its production in the dry way is to two American chemists who published their work in 1916. Dr. Percy should receive credit as the first observer, some sixty years ago, and the work of Pelouze, by precipitation, might have been mentioned. In view of the industrial importance of iron-oxide basic slags, reference should have been made to recent determinations of the eutectic point and other properties of the series. The brittleness due to exposure of iron or steel to acid attack is stated to have been first observed by Johnson in 1873, but here again it seems that work by Dr. Percy may have been overlooked. Roberts is credited with observing in 1881 that the surface colours produced on steel when heated in air are due to the formation of oxide; but Sir H. Davy had proved the same fact more than half a century earlier.

The main criticism is one which may not appeal to all readers of these volumes. Dr. Friend adopts as his method of classification the Periodic Table. The result is that from a practical, and particularly from a metallurgical standpoint, the elements sometimes find themselves in strange company. Thus in Group 2 are included sodium, potassium, hydrogen, copper, silver, and gold; the properties and reactions of these elements are so diverse that it is probable that an equally good classification would be obtained by placing the symbols in a hat and drawing at random. In carrying out this classification in the volume, the headline over 60 pages in Chapter VII. is "Iron and the Elements of Group VI." Included are oxides, hydroxides, sulphides, sulphates, alums, selenides, etc., any of which would be more readily found under a suitable headline. Then, on the last page of this same chapter, and under the same headline, "iron and chromium" seems to slip in, as it were from nowhere, and iron and molybdenum, and iron and tungsten, are omitted altogether. One doubts whether the ordinary reader would consider it an advantage to find, say, ferrous ammonium sulphate and chrome iron ore included under the same general headline. This criticism is aimed at the general plan of classification adopted in the book, which the reviewer well knows is one which has been largely favoured by modern teachers of chemistry. Those who prefer this classification will find little fault with the volume, for it represents much careful and discriminating work, and consequently will be helpful to teachers, students, and practical men.

Thomas Turner.

PUBLICATIONS RECEIVED.

Handbook of Chemistry and Physics. *By* C. D. Hodgman, *assisted by* M. F. Coolbaugh *and* C. E. Senseman. *Pp.* 711. (*London: Chapman and Hall, Ltd.* 1921.) *Price* 24s.

Soil Conditions and Plant Growth. *By* E. J. Russell. *The Rothamsted Monographs on Industrial Science. Pp.* 406. (*London: Longmans, Green and Co.* 1921.) *Price* 16s.

Bleaching. *By* S. H. Higgins. *Publications of the University of Manchester. Economic Series. No. XVI. Pp.* 137. (*Manchester: University Press; London: Longmans, Green and Co.* 1921.) *Price* 10s. 6d.

The Carbonisation of Peat in Vertical Gas Retorts. *Technical Paper No. 4. Fuel Research Board, Department of Scientific and Industrial Research. Pp.* 16. (*London: H.M. Stationery Office.* 1921.) *Price* 6d.

Kautschuk und Flechtenstoffe. *By* E. Fonrobert, C. Harries, V. Grafe, *and* W. Brieger. *Handbuch der Biologischen Arbeitsmethoden herausgegeben von* Prof. E. Abderhalden. *Abt.* 1, *Chemische Methoden, Teil* 10, *Heft I. Pp.* 438. (*Berlin: Urban and Schwarzenberg.* 1921.) *Price* 120 *mk.*

The Silver Bromide Grain of Photographic Emulsions. *By* A. P. H. Trivelli *and* S. E. Sheppard. *Monographs on the Theory of Photography from the Research Laboratory of the Eastman Kodak Co. Edited by* C. E. K. Mees and M. S. Schramm. *Pp.* 143. (*New York: D. Van Nostrand Co.; Rochester, N.Y.: Eastman Kodak Co.* 1921.) *Price* 16s.

Notes on Inorganic Chemistry. *By* F. Francis. *Pp.* 244. (*Bristol: J. W. Arrowsmith, Ltd.* 1921.) *Price* 8s. 6d.

The Fixation of Atmospheric Nitrogen. *By* J. Knox. *Second edition. Pp.* 124. *Chemical Monographs, edited by* A. C. Cumming. (*London: Gurney and Jackson.* 1921.) *Price* 4s.

The Riddle of the Rhine: Chemical Strategy in Peace and War. *By* V. Lefebure, *with an introduction by* Field-Marshall Sir H. Wilson. *Pp.* 277. (*London: W. Collins Sons and Co., Ltd.* 1921.) *Price* 10s. 6d.

Monographs on Mineral Resources, with Special Reference to the British Empire. *Imperial Institute.* (*London: John Murray.* 1921.):—

Silver Ores. *By* H. B. Cronshaw. *Pp.* 152. *Price.* 6s.

Petroleum. *Prepared jointly with* H.M. Petroleum Department *and with the cooperation of* H. B. Cronshaw. *Pp.* 110. *Price* 5s.

Directory of Chemical Industries in Canada, Dated January 1, 1921. *Pp.* 109. *Dominion Bureau of Statistics. Ottawa,* 1921.

THE FORMATION OF CARBOHYDRATES IN PLANTS.

E. C. C. BALY AND I. M. HEILBRON.

There is no doubt that of all the chemical processes which take place the most interesting and fundamental is the formation of carbohydrates in the living plant. It presents a peculiar fascination from the complexity of the products and the simplicity of the materials from which it starts. In some mysterious way the plant can synthesise a class of compound with giant molecules and structure yet unsolved from only water and carbon dioxide.

It suggests itself to all who try to solve the riddle, as indeed was first proposed by von Baeyer, that the first stage in the process is the production of formaldehyde, the chemistry of the reaction being represented by the equation $CO_2+H_2O=CH_2O+O_2$. The second stage would then consist of the polymerisation of the formaldehyde to give sugars, the molecules of which by condensation and loss of water form complex carbohydrates of the general formula $(C_6H_{10}O_5)_n$. The intricacy of the mechanism of these condensations and the constitution of the simpler complexes are rapidly finding solution. As an example of this we need only refer to the work of Irvine on inulin and cellulose[1]. There are, however, other facts than those of simple chemistry. In the equation given above the sum of the energy contents of the products is greater than the sum of the energy contents of the reactants, and therefore CO_2 and H_2O alone cannot give formaldehyde unless energy is supplied to them. Again the polymerisation of formaldehyde to give sugars is also a reaction which cannot take place without energy being supplied. The energy necessary for the complete synthesis (the same total amount of energy being of course necessary even if formaldehyde is not an intermediate stage) is absorbed by the plant in the form of light, since it is known that the assimilation of CO_2 by the leaves does not take place in the dark. There can be no doubt that the chlorophyll in the living leaf absorbs visible light, thereby gaining the energy necessary for the synthetic process, and it is the mechanism of this energy transference which is the crux of the enigma.

The whole problem divides itself into two parts, each of which requires investigation. On the one side we have the chemistry of the process, that is the nature and number of the stages that are associated in the complete synthesis. On the other side we have the physical laws which govern the energy uptake, the absorption of this energy by the living leaf and its utilisation for its proper end. Although it is a natural assumption that the first stage is the production of formaldehyde, this view receives little or no support from numerous investigations that have been made, since no trustworthy evidence has been found of the existence of free formaldehyde in the living leaf. This, however, is a point of minor importance, as indeed a knowledge of the whole of the chemical reactions involved is of little use to us unless we understand the mechanism by which the leaf absorbs and utilises the energy required to promote these reactions.

It is a well-established fact that an aqueous solution of CO_2 exercises no power of absorbing visible light, but that it absorbs ultra-violet light of extremely short wave-length. It is a necessary consequence of this fact that in order to gain the energy required for the first stage of the synthesis the CO_2 and H_2O must be exposed to light of this very short wave-length. Since sunlight includes at the most only a minute quantity of this light, the synthesis cannot be initiated by sunlight. It may be emphasised that the chemistry of the process is not involved in this statement. Whatever may be the reactions involved in the synthesis, the synthesis cannot start without the absorption of energy by the CO_2 and H_2O. How then does the plant succeed in carrying out the synthesis in sunlight?

The answer to this question seems to have been found in a quantitative study of another photochemical reaction, namely, the combination of hydrogen and chlorine under the influence of light. This reaction is a simple one that can be controlled, and it is one which is sufficiently rapid to allow quantitative measurements to be made. It was found that the velocity of this reaction is not proportional to the intensity of the light, but increases far more rapidly than the intensity. Expressed in other words, the amount of HCl formed with a given quantity of energy absorbed is not constant, but increases rapidly to an explosive maximum as the intensity of the light is increased. This result, which at first sight is very surprising, may readily be understood if the whole of the process is considered. The chemical reaction is expressed by the equation $H_2+Cl_2=2HCl$, but before the reaction can take place it is necessary to render the chlorine molecule active by supplying energy to it. We have therefore $H_2+Cl_2+E=2HCl+E+K$, where E is the amount of energy absorbed in activating the chlorine molecule and K is the ordinary observed heat of formation of two molecules of HCl. Now the total energy E+K is radiated in the form of heat by the two molecules of HCl or, expressed in scientific language, the energy is radiated at infra-red frequencies which are characteristic of the HCl molecule. It has been proved, however, that many of the infra-red frequencies of a compound molecule are identical with those of its component atoms, and consequently the molecules of HCl and Cl_2 have some infra-red frequencies in common. The energy E+K therefore will partly be re-absorbed by the surrounding Cl_2 molecules, with the result that these become partially or wholly activated. The proportion of the radiated energy E+K that is re-absorbed depends upon two factors, the density of the chlorine and the density of the radiation, or, what comes to the same thing, the intensity of the incident light. It was shown by Bodenstein and Dux[2] that with a constant intensity of illumination the amount of HCl formed with unit quantity of energy absorbed varies as the square of the density of the chlorine. It has also been found, as stated above, that when the density of the chlorine is kept constant, the amount of HCl formed with unit quantity of energy absorbed increases very rapidly as the intensity of the illumination is increased[3]. These results very definitely prove the re-absorption of the radiated energy by the Cl_2 molecules.

The principle is applicable to all photochemical reactions, and may be made use of in promoting a reaction when the reactant molecules are screened from the ultra-violet rays they normally require. It should only be necessary to mix with the reactants a substance A which absorbs rays different from those characteristic of the reactants, but which has the same infra-red frequencies as the reactants. When the mixture is exposed to rays absorbed by the substance A the energy thus absorbed will be radiated at the infra-red frequencies characteristic of A, and since these are the same as those of the reactant molecules the latter will re-absorb this radiation and the reaction will take place. This process we have called "*photocatalysis*," the substance A being the photocatalyst. The suggestion may be made that in the living plant the chlorophyll acts as a photocatalyst. It absorbs visible light and radiates the energy in the infra-red, and if its infra-red frequencies are the same as those of carbonic acid, this energy will be re-absorbed by the latter, with the result that the synthetic process will take place even though none of the ultra-violet light normally required by the carbonic acid has been utilised. The probability of this explanation is very materially strengthened by the fact that another photochemical reaction has been successfully photocatalysed, namely, the decomposition of nitrogen pentoxide[4].

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[1] Trans. Chem. Soc., **117**, 1474, 1489 (1920).

[2] Zeitsch. phys. Chem., **85**, 297 (1913).

[3] Baly and Barker, Trans. Chem. Soc., **119**, 653 (1921).

In order to put this suggested explanation of carbohydrate synthesis to the test it is necessary first of all to investigate the chemistry of the synthesis and determine whether formaldehyde is produced or not as an intermediate stage. The second step will be the inquiry as to whether the reaction or reactions can be photocatalysed. It is desirable that the investigation of the synthesis and its photocatalysis should be carried out in the absence of living matter, so that the theory may be tested in the absence of all influences, such as enzymes, which are secondary to the main principle. It may be stated at once that we have found the first stage to be the production of formaldehyde, which is then polymerised to carbohydrates, and that both stages can be photocatalysed.

We may discuss firstly the synthetic process and its component stages, and secondly the photocatalysis of these stages. The initial materials are CO_2 and H_2O, and the first point to be investigated is the nature of the products when carbonic acid is exposed to very short wave-length light, the expectation being that formaldehyde is produced. The problem was investigated a few years ago by Moore and Webster[5], who published a series of interesting results which will be dealt with *passim* in what follows. These authors stated that a saturated aqueous solution of CO_2 gives no formaldehyde on exposure to ultra-violet light, but that in the presence of certain inorganic "catalysts," *e.g.*, colloidal ferric hydroxide, beryllium chloride, etc., small quantities of the aldehyde are produced. They concluded that an inorganic catalyst is necessary for the formation of the formaldehyde, and they go to some trouble to prove the presence of iron in the growing plant. We have repeated these experiments, and have confirmed the fact that the aqueous solution of CO_2 on exposure to ultra-violet light does not give any evidence of formaldehyde when it is undisturbed. If, however, during the exposure the solution is agitated by a stream of bubbles of CO_2, very distinct traces of formaldehyde can be detected after a few hours. This at once disposes of the necessity for an inorganic catalyst and the contention that such must be present in the plant. There are two reasons why the carbonic acid solution must be agitated in order to obtain a positive test for formaldehyde. There is no doubt that the reaction is expressed by $CO_2+H_2O=CH_2O+O_2$, and the question arises as to what happens to the oxygen. In ultra-violet light oxygenated water forms hydrogen peroxide, and therefore the formaldehyde will be very liable to be oxidised to formic acid. We have proved this point by detecting the presence of formic acid in the solutions after long exposures. The agitation of the solution decreases the local concentration of the hydrogen peroxide, and the tendency towards oxidation of the formaldehyde decreases, with the result that the positive test for the formaldehyde can be obtained.

The second reason for the effect of the agitation is to be found in Moore and Webster's own work, since these authors found that formaldehyde in aqueous solution is polymerised to reducing sugars by ultra-violet light. If the solution is not agitated, the formaldehyde which escapes oxidation is polymerised as fast as it is formed, and therefore its presence will not be detected. Agitation of the solution carries part of the aldehyde to the back of the vessel, where the actinic intensity of the light is less and the polymerisation is slower. Some formaldehyde will then be capable of detection in the solution.

We have found that the aldehyde is polymerised by long wave ultra-violet light, whilst its synthesis from CO_2 and H_2O requires short wave-length ultra-violet light. If a substance is present which absorbs the former rays only, it is evident that formaldehyde will be produced in larger quantity. This we have proved by adding to the solution of CO_2 small quantities of paraldehyde or sodium phenoxide. These two compounds absorb the long wave-length ultra-violet light, and therefore protect the formaldehyde from polymerisation. We have also proved that the so-called inorganic "catalysts" of Moore and Webster play the same rôle: they are not catalysts, but protectors of the formaldehyde when formed.

Reference may be made to Moore and Webster's statement that all substances of biochemical origin give formaldehyde when exposed in aqueous solution to ultra-violet light. This at first sight would seem to throw doubt on the synthesis of these compounds from CO_2 and H_2O with formaldehyde as the intermediate stage, but the statement is incomplete and therefore somewhat misleading. It is true that formaldehyde is produced in each case, but a reducing sugar is formed at the same time. We have also found that acetone and oxalic acid in aqueous solution both give formaldehyde and a reducing sugar on exposure to ultra-violet light. It is a matter of common knowledge that these two substances do not give formaldehyde as a direct photochemical decomposition product, but CO_2 and other simple compounds. The formaldehyde and sugars must therefore have been formed by photochemical synthesis from the CO_2 and H_2O, and in all probability the same is true with the substances of biochemical origin. There is little doubt that in ultra-violet light a photo-equilibrium is established between carbohydrate, formaldehyde, and carbon dioxide of the type

$$\begin{tikzcd}
\text{Carbohydrate} \arrow[rr] & & \text{Carbon dioxide} \arrow[dl] \\
& \text{Formaldehyde.} \arrow[ul] &
\end{tikzcd}$$

There is considerable evidence in support of the existence of this equilibrium which need not be detailed. We have endeavoured to carry out the photosynthesis of a sugar from CO_2 and H_2O in one vessel, using a saturated solution of potassium bicarbonate so as to shift the equilibrium as far as possible to the side of the sugar. Only very small traces of a sugar were formed, this being due to the fact that the formaldehyde was largely oxidised to formic acid. The results described above, however, leave no doubt that carbohydrates are photosynthesised from CO_2 and H_2O, formaldehyde being first produced.

The photocatalysis of the two stages of the catalysis may now be discussed. In order that the first step may be photocatalysed a substance must be used which has the same infra-red frequencies as CO_2, and we have found that a coloured base such as malachite green acts as a photocatalyst. Its colour is due to the absorption of visible light, and being a base it forms an addition compound with the CO_2, thereby ensuring the requisite identity of infra-red frequency, since both components of a complex have been proved to possess identical infra-red frequencies[6]. An aqueous solution of malachite green saturated with CO_2 gives, on exposure to visible light only, decided amounts of formaldehyde. Methyl orange and *p*-nitrosodimethylaniline also act as photocatalysts for the first or formaldehyde stage in carbohydrate synthesis.

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[4] Daniels and Johnston, J. Amer. Chem. Soc., **43**, 72 (1921).

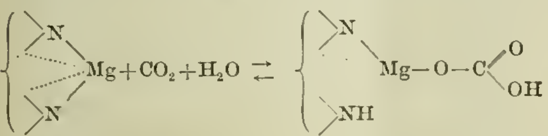
[5] Proc. Roy. Soc., [B] **87**, 163, 556 (1914); **90**, 168 (1918).

[6] Baly and Tryhorn, Phil. Mag., **31**, 417 (1916).

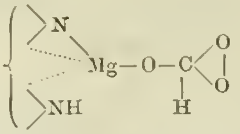
For the photocatalysis of the polymerisation of formaldehyde a coloured substance must be found which forms an addition complex with the formaldehyde, but we have not yet succeeded in finding such a substance. We have carried out collateral experiments which leave no doubt of the possibility of this photocatalysis. For instance, an aqueous solution of sodium citrate and sodium carbonate gives a reducing sugar on exposure to ultra-violet light, this synthesis not taking place in visible light. On the other hand, Benedict's solution, which contains copper sulphate, sodium citrate, and sodium carbonate gives marked reduction after exposure to visible light. This is a clear case of photocatalysis, since in the presence of copper the synthesis is induced by the absorption of visible light, the copper acting as a photocatalyst.

It may be emphasised, therefore, that carbohydrates can be synthesised from CO_2 and H_2O, and also that formaldehyde is produced as the first stage. The two stages require light of different wave-lengths for their accomplishment, and both stages can be photocatalysed. It must be remembered, however, that in the living plant the process does not show any definite signs of passing through the formaldehyde stage. On the other hand, if the photocatalyst present in the leaf is capable of bringing about both stages, it is obvious that free formaldehyde would not be formed, since the complete process would take place within the same complex. Failure to establish its presence by the most delicate of tests can no longer be accepted as evidence against formaldehyde being the first stage in the phytochemical synthesis of carbohydrates from CO_2 and H_2O. It would seem very probable from its chemical nature that chlorophyll is an ideal substance for acting in the dual capacity of photocatalysing both stages. It is coloured and therefore absorbs visible light from the sun. It possesses the power of forming addition compounds with carbonic acid in the first place and of retaining within the complex the formaldehyde when formed. The identity of the infra-red frequencies necessary for the photocatalysis is therefore secured throughout the two stages. Reference may also be made to the influence of the chlorophyll on the photo-equilibrium already described as existing between carbohydrate, formaldehyde, and carbon dioxide. The chlorophyll will undoubtedly shift the equilibrium entirely towards the side of the carbohydrate, since it absorbs those rays which decompose the carbohydrate. For this reason the plant will be able to form carbohydrates when the concentration of the carbon dioxide is very small.

The work of Willstätter and his colleagues is of peculiar value in light of this theory of photocatalysis, quite apart from its outstanding importance on the purely chemical and botanical sides. The essential condition laid down above for the chlorophyll to act as photocatalyst is that it must form an addition compound with carbonic acid in order that the identity of the infra-red frequencies may be assured. This combination Willstätter has proved to take place when the chlorophyll is in colloidal aqueous solution, this approximating to the natural condition. He believes that the mechanism of the combination is as follows:—



Under the influence of light the second molecule passes with absorption of energy into the formaldehyde peroxide compound



and this would correspond to the first stage of the photocatalysis. The very accurate experimental proof Willstätter gives that during the photochemical synthesis the molecules of oxygen evolved exactly equal in number the molecules of carbon dioxide absorbed affords conclusive independent support of the evidence now adduced in favour of the synthesis passing through the intermediate stage of formaldehyde.

Willstätter states that chlorophyll has not the power of forming an addition compound with formaldehyde, but this does not militate in any way against the theory herein set forth, since free formaldehyde as such is not formed in the plant. The theory states that in the presence of the photocatalyst the synthesis of the carbohydrate from carbonic acid is carried through without a break. The chlorophyll-carbonic acid complex does not stop absorbing energy when the first or formaldehyde stage is completed, for in sunlight the absorption of energy by the complex is necessarily continuous. The formaldehyde peroxide complex can only have a very transient existence: it is merely a condition through which the original carbonic acid complex passes during the accretion of energy. The final stage is the de-oxidation of the formaldehyde peroxide body and the splitting off of the formaldehyde in an activated form which instantly polymerises to form a sugar. The activated form of formaldehyde also marks the initial stage of the polymerisation of this substance in ultra-violet light. As each molecule absorbs energy it becomes activated, and it is this active form which undergoes polymerisation to sugars. This is exactly analogous to the activation of chlorine by light previous to its union with hydrogen to give hydrogen chloride.

The results now brought forward can only be considered as preliminary, but it would seem that they throw a little light on the mechanism of phytochemical synthesis. They show that carbohydrates are synthesised in ultra-violet light from CO_2 and H_2O through formaldehyde as an intermediate stage. They show that the whole process takes place in visible light only when a photocatalyst is present. They show that chlorophyll can act as a photocatalyst for the synthesis. But even yet great mystery shrouds the vital process. Nothing yet is known of the functions of chlorophyll A and B, which on Willstätter's showing are in constant equilibrium during photosynthesis, and so we wonder why Dame Nature uses both. It may be that the de-oxidation of the formaldehyde peroxide complex causes a temporary disturbance of this equilibrium, the de-oxidation being caused by the oxidation of the excess of uncarbonated chlorophyll A to chlorophyll B. So long as the ratio of oxygen molecules evolved to molecules of carbon dioxide absorbed remains constant, any shift in the equilibrium between chlorophyll A and chlorophyll B will be incapable of detection.

The consideration of such problems are these, together with the asymmetric synthesis of optically active sugars, Willstätter's suggestion of enzyme action, and many others, must be left to the future. The recognition of these most enchanting avenues of progress has restricted us in the first instance to a study of the problem in the simplest possible way, with the conviction that there could be no hope of final success until the elemental difficulties of understanding were surmounted.

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THE ALUMINIUM INDUSTRY IN GERMANY.*

Prior to the war aluminium was made in Germany solely at one small works, viz., the branch of the Aluminiumindustrie A.-G., of Neuhausen, Switzerland, situated at Rheinfelden in Baden. The output was only 800 metric tons per annum, and the remaining German requirements were supplied by Swiss, French, and English producers. In the middle of May, 1915, when the supply of metals for war purposes was causing the Government considerable anxiety, there was only 4000 tons of aluminium in the country, and great difficulty was experienced in obtaining supplies from Switzerland. In consequence, seven new works were built, and that at Rummelsburg, near Berlin, started production at the end of 1915 at the rate of 3500 t. per annum, the greater part of the output being used by the Kraftwerk Golpa Co., of Berlin, to replace copper in electrical conductors and cables. Each of the works at Horrem, Bitterfeld and Grevenbroich in the neighbourhood of Cologne started to produce in 1916–17 at the rate of 4000 t. per annum, but the first two have suspended operations since early in 1920.

The necessary electrical energy for the works at Grevenbroich is generated from lignite at Knapsack, near Cologne, and conveyed by means of four aluminium conductors at 100,000 volts A.C. to the works, where it is transformed down to 5000 volts, and used to drive 15 A.C. motors each coupled on both sides to dynamos generating the direct current required for electrolysis. All the leads and electrical connexions in the works are made of aluminium, and a total of 250 t. of the metal has been used with very satisfactory results. The factory is built on the Swiss model and includes a refinery and a plant for the manufacture of the necessary electrodes; the output capacity is about 100 t. per month with a current yield of 70 per cent.

All the works follow the usual method of electrolysing alumina in a bath of molten cryolite. The bath is a rectangular vessel made of the same material as the electrodes and forms the negative pole of the circuit, the anodes consisting of a bundle of 8—12 rods dipping in the bath from above. Electrolysis is carried out at 900°—950° C., and the bath is maintained between these limits by varying the current density and internal resistance, cryolite being added if the temperature tends to rise. The current is supplied at 2·1—2·2 volts, any tendency of the voltage to rise beyond the upper limit, showing that cryolite itself is being decomposed, being avoided by the addition of fresh alumina from time to time. Every 2—3 days the metal that has collected in the cells is removed and cast into ingots, and these are refined by melting in gas- or oil-fired reverberatories or in crucible furnaces, whereby the impurities and inclusions of fluoride rise to the surface and may be removed; the loss in weight during refining should not, with good work, exceed 3 per cent. Great difficulty is experienced in casting the metal into bars suitable for rolling or drawing into wire owing to the great contraction in volume it undergoes on solidification and to its tendency to absorb gases. There is also the possibility that oxide may be included in the castings as the difference in specific gravity between metal and oxide is very small, and, although the oxide floats on the surface of the molten metal, corundum-like masses may be found in the bottom of the furnace. The purer the aluminium to be cast, the more difficult is it to obtain sound castings, but a pouring temperature between 700° and 750° C., according to the size of the ingot, has been found to give the best results. In the rolling process the ingot is first passed at a temperature of 390°—450° C. through rolls 61 cm. diameter by 213 cm. wide running at the rate of 1 m. per sec. until reduced to a thickness of 8 mm. It is then cross-rolled cold to the requisite thickness, and the finished sheet, before cutting, is annealed for ½ hr. at 375° C. Any flaws in the casting show themselves during rolling by the metal breaking or developing a foliated appearance. A method has been developed for improving the physical properties of pure aluminium by some form of mechanical treatment, probably pressing, in conjunction with heat treatment, but the details are kept secret. The metal thus obtained is known as "Aludur," has a Brinell hardness number of 80 combined with a high ductility and resistance to shock, good electrical conductivity and resistance to corrosion.

The total annual production of aluminium in Germany is at present approximately 15,000 metric tons, of which about 5000 t. is exported. The German works, however, are said to be capable of producing nearly 100,000 t. per annum, but the difficulty of obtaining supplies of bauxite, of which Germany has only limited resources, labour troubles, and the dependence of the industry upon lignite for its supplies of power have tended to keep down the production. During the war most of the bauxite used in Germany was obtained from Siebengürgen, Istria, Dalmatia and the Adriatic islands, but now these ores are too costly, and attention is being turned to working up the low-grade ores of Vogelsberg, in Hesse, and Untersburg, near Salzburg, and more particularly to working out a method for the production of alumina from clay and other silicates. Every effort is being made to cheapen the cost of production, especially the cost of current. It has been calculated that the water power of northern German-Austria could be utilised to supply 3—4 million h.-p. of electric energy at a cost, including interest and sinking fund on the capital outlay for the erection of power-houses, of 400 mk. per h.-p. per annum, or, on a basis of 8000 hrs. use, of 5 pfg. per kw.-hr. at present prices. Similarly, the water-power resources of southern Bavaria could supply 2 million h.-p. at 3—4 pfg. per kw.-hr. It has been found in practice that 30 kw.-hr. is necessary to produce 1 kg. of aluminium, so that considerable economy could be effected by the substitution of water power for coal.

The market price of aluminium in Germany, which before the war varied from 1·5 to 1·8 mk. per kg., had risen to 7—8 mk. at the beginning of 1919. In the middle of that year the price began to increase very rapidly until in February, 1920, it had reached 58 mk., after which it began to fall. If these prices, however, are calculated on a gold basis, there is seen to be only a slight fluctuation between 2 and 3 mk. per kg.; at the end of 1920 the price was about 2 mk. (gold) per kg., compared with 2·3 mk. in America and 3 mk. in France.

The outlook for the aluminium industry in Germany appears to be fairly bright, especially as the metal and some of its alloys are being used more and more as a substitute for copper with considerable saving in expense, as Germany has to import the bulk of her copper supplies. Aluminium is now being used extensively in Germany in the telephone service, for roof coverings, door handles and similar household articles, and even for the doors of railway carriages, in addition to the ordinary uses to which it is put in this country. With increased knowledge of the technique of making, casting, and working the metal, to which a large amount of research is being devoted, there is no doubt that it will be much more widely used in the future, especially in the electrical industry.

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* Abstracted from a lecture delivered before the Deutsche Gesellschaft für Metallkunde by Dr.-Ing. R. Sterner-Rainer, and published in the *Zeitschrift für Metallkunde*, 11, Aug., 1921.

THE EXPLOSION AT OPPAU.

On the morning of September 21 the synthetic-ammonia factory at Oppau (*cf.* J., 1921, 99 R) was the scene of one of the most disastrous explosions which has ever occurred in chemical industry. The factory, which is worked by the Badische Anilin- und Sodafabrik, has since 1920 been under the control of the Ammoniak-Werke Merseburg-Oppau, a branch of the Interessengemeinschaft (" I.G."). An eye-witness states (*The Times*, Sept. 23) that he saw a high column of flame shoot up, followed almost immediately by a detonation which knocked him down; there was a short interval, estimated at two or three seconds, then a second much more violent report, and a great fog of dust and fumes spread over the works and village. Ammonia gas is also reported to have escaped in large quantities, indicating injury to the synthetic-ammonia apparatus. The greater violence of the second detonation is also confirmed by a seismograph record. All church clocks in the neighbourhood stopped at 7.33 a.m. The general material effect of the explosion is described as most serious, and this is confirmed by the photographs published in the *Daily Mail*. One of the three chimneys was blown down, and the framework of the buildings where the explosion occurred was badly twisted. Large fragments of machinery were blown about, reaching as far as the village. In the village itself, which has a population of 5000, about 75 per cent. of the houses is in ruins or uninhabitable. A crater 400 ft. in diameter and over 90 ft. deep was formed on the site of the explosion and is slowly filling with water. The explosion was felt at Karlsruhe, Heidelberg, and Mannheim. Important damage was done at Mannheim, which is four miles distant, where three persons were killed and seventeen injured and the concussion was felt at Munich, 175 miles distant. The casualty roll at Oppau was grievous. At the time of the explosion there were 850 people in the works. The death roll has been variously stated; the first reports gave 700 killed and over 1500 injured, the latter figure including many casualties in the village. Later reports gave the number of killed at 1000—1100, including casualties in the village; the *Chemiker-Zeitung* (Sept. 27) gives over 400 dead and several hundreds injured, which is probably a minimum estimate. Up to the present over 200 bodies have been recovered, but many more must have been buried or dispersed by the explosion. The wreckage is guarded by French troops, who rendered important assistance immediately after the explosion, and the French Commissioner at Coblenz sent 75,000 marks for relief work. General Degoutte proceeded at once to Oppau.

At the present value of the mark, the insurance is estimated to cover 50 per cent. of the loss. The Oppau works was insured with the Bavarian State Fire Insurance, and the stock with private companies for 138 million marks until 1923. Of this, 20 per cent. was effected by the combine itself, leaving 80 per cent. to fall on the insurance companies.

The somewhat optimistic report of the directors, considered later, seems a little out of place in the face of a catastrophe of this magnitude, and the statement attributed to them (*The Times*, Sept. 23) that they " hope to have the factory working again in about six months " will doubtless turn out to be a little premature. The German Government has been deeply impressed by the event, and a Committee of Inquiry has been appointed by the Reichstag.

Suggestions as to the cause of the explosion have been conflicting. The following have been put forward:—(i) Explosion of hydrogen; (ii) explosion in a research laboratory; (iii) explosion of gas generators or compressors; (iv) explosion of a store of material. The last, which seems most probable, is put forward in the report of the directors, dated Ludwigshafen (which seems to have suffered very slightly), September 23, and published in the *Chemiker-Zeitung* of October 9 and the *Zeit. angew. Chem.* of October 4. This report gives the following account of the explosion.

The cause of the disaster, it is stated, has definitely been traced to the explosion of a store of 4500 tons of " Ammonsulfatsalpeter " (*cf.* i.). Long and careful researches, extending over years, had given no indication that this material was explosive. Shortly after the end of the war the works had changed over from the exclusive manufacture of ammonium sulphate as a fertiliser to one containing ammonium nitrate. It was concluded that the product could be stored and transported without danger, and there was no stock of ammonium nitrate at Oppau. The explosive properties of ammonium nitrate were found to be completely eliminated by chemical decomposition with sodium or potassium chloride. Thus, the explosive properties of ammonium nitrate disappeared when 60 parts of it was mixed with 40 parts of potassium chloride, " especially when the chemical reaction had occurred." In this way the requirements of agriculture for a quickly acting nitrate-nitrogen fertiliser could be satisfied and a valuable material produced from ammonium nitrate. The method employed was to bring about the double decomposition, in the presence of moisture, of a mixture of approximately equal weights of ammonium nitrate and potassium chloride, whereby principally a mixture of potassium nitrate and ammonium chloride was produced, known as " Kaliammonsalpeter," and this was said to be non-explosive and safe to store in large amounts. Similarly, a material called " Ammonsulfatsalpeter " was produced by the interaction, in the wet way, of approximately equal weights of ammonium nitrate and ammonium sulphate. The capabilities of ignition and explosion of this were studied exhaustively. The two salts are said to form a double salt, $(NH_4)_2SO_4,2NH_4.NO_3$, which contains 54·8 per cent. of the nitrate and 45·2 per cent. of the sulphate and is not explosive. In the manufacture, equal weights of the constituent salts were used, so that the product, which was always obtained in the wet way, contained a slight excess of ammonium sulphate, and this was apparently regarded as a further safeguard. In numerous experiments with the Trauzl block, with material containing less than 60 per cent. of ammonium nitrate, the expansion was never greater, and was usually less, than that produced by the powerful initiating detonator alone (" Sprengkapsel 8," with 2 grams of mercury fulminate). No indications of an explosive character were observed in the material whether a double salt had formed or not, and it was concluded that its storage in large quantities was permissible. The remarkable statement is made that *hard blocks of the material had often been blasted* (" gesprengt ") *without indications of unfavourable results.* The initial cause of the explosion, it is stated, can now hardly be ascertained, since all the personnel concerned have lost their lives. The statement that Oppau is completely destroyed is said to be inapposite; the synthetic-ammonia and ammonium-sulphate plants are relatively slightly damaged and the further operation of this section may be expected at a not too distant date. It is quite certain that the explosion and its cause had no connexion with the synthetic-ammonia process.*

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* In connexion with the manufacture of the mixed fertilisers the following patents of the Badische Co. may be consulted: G.P. 306,334 (1916), 310,601 (1920), 336,876 (1918), 307,112 (1916); E.P. 145,036 and 145,037 (1920); also Akt.-Ges. für Anilin Fabr., E.P. 146,259 and 145,582 (1920).

The following remarks may be made concerning the statement by the Badische company. If the explanation given is correct, the research work must have been faulty and negligence shown in storing large quantities of the material before really stringent tests had been made with relatively large amounts of material stored over intervals of time. If the statement is incorrect, as the first part of the report seems anxious to establish, then what is the correct explanation? It is of no value to suggest that as all records have been destroyed, the knowledge of the true cause is beyond reach. The conditions on the site of the explosion must be known, *e.g.*, whether the blasting operation was usually practised there and was likely to have been used on the particular morning when the explosion took place. If the effect was so local as the directorate suggests, it should not be difficult to narrow down the investigation considerably. The next step is obviously to make a most searching and exhaustive inquiry, in which the most competent scientific and technical experts of Allied countries should join forces. The explanation offered by the Germans cannot be taken at its face value; it contains many obviously weak points. It is well known that a mixture of potassium chloride and ammonium nitrate liberates chlorine under conditions which may very well have been present in the silos. Chlorine with ammonium salts forms nitrogen trichloride. This would occur only after storage and would not be detected in the laboratory experiments. It is by no means certain that the double decompositions "in the presence of moisture" occurred as described. Ammonium nitrate and potassium nitrate form mixed crystals having the appearance of potassium nitrate but containing considerable amounts of free ammonium nitrate (Caillart, *Bull. Soc. franc., Min.* 1918, 41, 21). F. A. H. Shreinemakers and P. H. J. Hoenen (*Chem. Weekblad*, 1909, 6, 51) investigated the double salts of ammonium nitrate and ammonium sulphate and obtained two:—$(NH_4)_2SO_4,2NH_4.NO_3$ and $(NH_4)_2SO_4,3NH_4.NO_3$. The latter is not mentioned in the Badische communication. Both salts are deposited from aqueous solutions at 30° C., but are decomposed by water, *being stable only in presence of excess of ammonium nitrate.* The bearing of this on the present case is obvious. In spite of the statement that the test with the detonator was applied also to material which had not reacted, there seems abundant opportunity for error. Another possibility is suggested by E. Hene (*Chem. Zeit.*, Oct. 6), who states that the Trades Union representative in the Reichstag, Brey, testified at a sitting of that body that the surface of the stock of fertiliser had altered and the temperature of the mass had slowly risen. Hene suggests that, in the presence of acidity in the ammonium salts, free nitric acid might have been liberated which would react with ammonium sulphate as follows:—(i) $6HNO_3 + 5(NH_4)_2SO_4 = 18H_2O + 8N_2 + 5H_2SO_4 + 536$ Cal.; (ii) $2HNO_3 = 2NO_2 + O + H_2O$; (iii) $N_2O_3 + (NH_4)_2SO_4 = H_2SO_4 + 3H_2O + 2N_2 + 138$ Cal. These reactions are autocatalytic. Lengthy storage, high pressure in the interior of the mass, and the slow evolution of heat, retained by the badly conducting material, might have led ultimately to explosion. It is suggested that the explanation of the I.G. directorate is highly unsatisfactory. Many other points might be raised, but the above seem worthy of consideration. Another matter which might be considered by the Allied experts is the contents of the silos. These, it is said, contained 4500 tons of harmless fertiliser, which afterwards exploded. They were known to have a capacity of 50,000 tons. What else did they contain?

The statement that the explosion had nothing to do with the synthetic ammonia plant is probably true, but must not be taken on trust. An anonymous correspondent in the *Mining Journal* (Oct. 8) suggests that metallic or organic nitrides might have been produced, and these are explosive. These suggestions seem improbable, but dogmatism is always unfortunate in connexion with nitrogen compounds. The actual extent of the damage to the synthetic ammonia plant should be ascertained.

It is to be hoped and presumed that General Bingham with a technical staff is already at Oppau making a searching investigation. The German report is entirely useless and no reliance should be placed in it, or in any other statements from the same source. The situation is further complicated by the explosion of the saltpetre factory at Kleinlaufenberg, near Karlsruhe, on September 23, when seven men were killed and severe material damage occasioned. A correspondent in the *Chemical Age* (Oct. 8) reports the explosion of ammonium nitrate on unloading from trucks in Germany, with disastrous results. Why should German ammonium nitrate explode in this way?

An expert correspondent in *The Times* complains that the Allied Missions had not sufficient official backing, and that the Germans put difficulties in the way. The first complaint could be got over in the proposed Allied Commission of Inquiry. The second complaint was doubtless to some extent the result of the composition of the Allied Missions. These included representatives of firms anxious to make themselves acquainted with German practice for commercial ends, and it is not in the least surprising that the Germans should put difficulties in the way of such people. This difficulty could be avoided by a careful choice of the personnel of the Commission. The Oppau mystery is one which imperatively demands solution. An inquiry by an Allied Commission is alone likely to lead to the desired result.

[NOTE.—Since the above was written, articles have appeared in *The Times* of October 14 and 17, which express similar views, but give more details of the action taken by the German commission of inquiry. Another deep silo, containing 8000 tons of the material, has been found near the site of the explosion and the workmen have asked that it should be flooded. Evidence was submitted that work had recently been speeded up, that the material had arrived at the silos in a warm state, that workmen had been discharged for refusing to work in the storehouse owing to the dangerous gas given off, and that the official regulations governing precautions where explosives were employed had not been exhibited. The official legal inquiry is being conducted by the Examining Magistrate of the Provincial Court at Frankenthal. The inquiry seems to have been boycotted by the German Press, and the examining judge has ruled that the materials should be kept secret. It is now known that the inquiry is not in any way under the control of the Inter-Allied Commission. In the *Metallbörse* (Oct. 8), it is also suggested that the explosion was due to nitrogen chloride, formed, conceivably, as follows:—The free ammonium chloride and nitrate present in the ammonium sulpho-nitrate decomposed when warm and in presence of hygroscopic water giving free hydrochloric and nitric acids (ammonia being evolved more readily than the acid component), and these acids reacted to yield nitrosyl chloride and chlorine. The Badische company is asked to state:—(1) If potassium-ammonium nitrate was stored anywhere near the 4500 t. of sulpho-nitrate that exploded. (2) If there was an explosion of potassium-ammonium nitrate or ammonium sulpho-nitrate prior to that of the main dump. (3) If commercial ammonium sulphate, which contains up to 1·5 per cent. free acid, was used in making the sulpho-nitrate, and (4) if the latter was adequately washed with water to remove free acid.]

SOCIETY OF CHEMICAL INDUSTRY.

ANNUAL DINNER IN LONDON.

As the annual dinner which is always held in conjunction with the Annual Meeting took place this year in a locality that proved to be inaccessible to most of our home members, the Council arranged that a similar function should be held later in the year in London; and it was thought that if the venture were successful an Annual Dinner in London might be held every autumn, for there are always many members who are unable to attend the Annual Meeting and who yet desire some opportunity for reunion. The dinner, therefore, which was held on October 7 in the Connaught Rooms, W.C., was somewhat of an experiment, and for this reason it was not made too formal. The date, which was selected to secure the attendance of Sir William Pope prior to his departure for Paris and India, proved to be a little too early in the autumn to suit the convenience of many members, but in spite of this the attendance was quite satisfactory—over 130 members and guests were present—and the proceedings passed off with the success that had been anticipated. Among those who sat at the high table were:—Sir William Pope (Chairman), Prof. H. E. Armstrong, Prof. J. S. S. Brame (President of the Institution of Petroleum Technologists), Mr. A. Chaston Chapman (President of the Institute of Chemistry), Mr. H. E. Field (President of the Institute of Brewing), Eng.-Vice-Admiral Sir George Goodwin (President of the Institute of Metals), Mr. F. W. Harbord (President of the Institution of Mining and Metallurgy), Sir Frank Heath (Secretary, Department of Scientific and Industrial Research), Sir Joseph Petavel (Director of the National Physical Laboratory), Capt. H. Riall Sankey (President of the Institution of Mechanical Engineers), Mr. A. Smetham (President of the Society of Public Analysts), Sir William Tilden, and Sir S. Russell Wells (Vice-Chancellor of London University).

Prof. H. E. Armstrong, proposing the toast of "The Society," referred to the recent visit to Canada and to the message of great goodwill which the visitors had brought back with them; and he proposed that a reciprocal message be sent from that dinner to our Canadian colleagues. Canada, he said, was undoubtedly the country of the future for chemists; it was the most power-full land in the world, and before very long much of our chemical industry would be transferred to its shores. There was a real opportunity for real chemistry in Canada, and if a band of our younger chemists, after six months' honest training, would emigrate thither, a new era of chemical activity in the Empire might result. "Efficiency before all things" must be the motto of the chemical industry, and in regard to such subjects as chemical warfare, the day had gone by when science should have anything to do with sentiment. Science must be developed to the utmost without fear of the consequences. In a remarkable paper Prof. Fierz had recently referred to the need of efficiency in the dye industry, in which there was going to be a tremendous amount of competition, and we must therefore not attempt to do everything, but rather to do a few things very well indeed. The Society of Chemical Industry had gone further than any other similar society in establishing branches outside of the motherland, and in asking him to propose this toast and to couple with it the name of his old pupil, Sir William Pope, it had paid him the greatest compliment possible; in Sir William he saw justified his own system of education, which was to avoid over-feeding in the educational sense and to let the student alone as much as possible.

Sir William Pope, in reply, said that in the Canadian Sections the Society had an asset of enormous value, and it behoved all at home to cultivate in every possible way the excellent relations which had been established between the Canadians and ourselves. It was perfectly clear that the Canadian members wished for nothing more than to join hands with us, and to work together for the good of the Society and the chemical industry of the Empire. Another notable feature of the visit to Canada and the United States was that the meetings were made the occasion of a real Anglo-Saxon demonstration on behalf of chemistry, as opposed to the German chemical interests in those countries. The American Section of the Society was obviously very powerful, even in the headquarters of the great American Chemical Society, and the relations between the two organisations were excellent. Practically all chemical interests in the United States were unified in the American Chemical Society, which was the most powerful and most wealthy chemical organisation in the world. Another object-lesson to be learned from across the water was the necessity for chemists on this side to co-operate more actively and to sink their individual differences for the common good. Dr. Ruttan, their new President, was an exceedingly able and level-headed man; he was the leader in the chemical affairs of the Dominion, closely in touch with legislation concerning chemical and other scientific research, and among scientific people he was probably the one man who was interesting himself in the public interest in chemical science. No better choice of a President of the Society could have been made at the present time.

The toast of "The Visitors" was proposed by Mr. E. V. Evans, who said that although the home chemical industry was not so flourishing as could be wished, there were definite signs of improvement. They could at least congratulate themselves that at last the Government and intelligent people had been brought to realise that the country must have a chemical industry and, in particular, an organic chemical industry. That was shown by the passing of the Dyestuffs Act, which was not a measure involving fiscal protection in the old political sense. The accomplishments of the dye industry, which was not like a weak child fed on Parliamentary "Glaxo" but a real sturdy youngster, had not been sufficiently appreciated. The dye industry had suffered many set-backs, such as that caused by the Sankey judgment, which gave rise to enormous importations of dyewares; but it had done something, as the figures of production and importation clearly showed. There were still, however, many probems to be solved, such as those relating to shades, prices, and continuity of output. Chemists would be called upon before long to solve a bigger problem than they had had before, viz., the supply of chemical plant. On its engineering side, in particular, our chemical industry would need the help of the sister sciences of physics, mechanics, and metallurgy, and it was in recognition of the interdependence of these branches of science and chemistry that they paid honour to the representatives of the allied societies who were present as their guests.

Sir George Goodwin, in reply, said that the activities of the Society of Chemical Industry touched those of almost every other industry, and that during recent years in his capacity of Engineer to the Fleet he had had many experiences of the value of the services of chemists. He congratulated the Society upon its *Journal*, which was one of the publications most sought after and appreciated by members of the Institute of Metals.

Sir Frank Heath said that owing to our straitened circumstances many post-war schemes of development might have to be dropped. Sacrifices, both individual and collective, would have to be made in the immediate future, but it was very important that the nation should not be called upon to lose more than was absolutely necessary of the means we now possessed of acquiring new knowledge. The country could only regain its position by establishing a superiority in means of production, and for this we must look mainly to science. There would be little danger of excessive sacrifices being demanded of those who by their labours add to the sum of human knowledge, if such varied interests as those represented in the Society of Chemical Industry would unite their forces and at the same time instil into public opinion the fundamental significance of scientific progress.

The toast of "The Chairman" was proposed by Dr. M. O. Forster, and after the proceedings had terminated a cablegram was sent to Dr. Ruttan conveying the best wishes of home members for a very successful period of office and the hope that his influence on behalf of the Society in Canada would be as persistent in the future as it had been successful in the past.

OCTOBER MEETING OF COUNCIL.

The first Council Meeting of the new session was held at the Society's offices on October 7. In accordance with the by-law which provides for the appointment of a chairman of Council during the absence of a president, Sir William Pope was elected to that office for the session 1921-1922.

After the Secretary had reported the results of conferences held in Montreal relating to Associates of the Canadian Sections, the rules of the Toronto Section and certain alterations in the rules of the Shawinigan Falls Section were approved.

It was unanimously resolved that, in addition to the letters of thanks which had already been sent to those who had entertained the Society in Canada and the United States, special letters, suitably engrossed, should be sent to the Montreal Section and to the American Chemical Society conveying to them the Council's appreciation of the hospitality that had been accorded to the members of the Society who participated in the visit. It was also agreed to convey to Mr. W. F. Reid, whose term of office as a member of Council has just expired, the Council's high appreciation of the services he has rendered to the Society over a long period of years.

Appointments were then made to the Publications Committee and to the General Purposes Committee, both of which have power to co-opt. The personnel of these committees will be published when they are complete, together with a list of the Society's representatives on outside bodies.

The following committees were not reappointed:—Finance; Technical, Research, and Allied Societies; Government and Parliamentary; Literary and Libraries; Emergency. These committees were originally appointed at a stressful period of the Society's history, and now that the conditions which necessitated their existence have, to a very great extent, disappeared, the Council has decided not to continue them. The work hitherto done by the Finance Committee will be taken over by the Hon. Treasurer, the advertisements in the *Journal* will come under the Publications Committee, and most of the remaining work, which formerly would have fallen to one or the other of the committees now abolished, will be dealt with directly by the Council.

Thirty-five candidates were elected members of the Society; of these 18 are resident in the United Kingdom, 10 in the United States, and 4 in the Dominions Overseas.

Latham Research Fellowship.

The new scheme for this Fellowship, proposed by Mr. C. F. Cross, and approved by the Council at its meeting in February last, has now been put into operation. The Fellowship, of the value of £180 per annum for two years, has been awarded to Mr. James Craik, M.A., B.Sc., of the University of St. Andrews, who was nominated by Principal J. C. Irvine. Mr. Craik will undertake, in the first instance, a study of progressive oxidations of bioses by hypochlorous acid, chromic acid, and hydrogen peroxide, and this will give a basis for the interpretation of results which will be extended to the colloidal carbohydrates of the starch, hemi-cellulose, and cellulose groups. It is hoped to include the study of the incidental physiological problems which will arise. The work will be carried out in the Chemistry Department of the University of St. Andrews.

Annual Meeting, 1922.

The next annual meeting will be held in Glasgow from Tuesday, July 4, to Friday, July 7, inclusive. This early intimation is given to inform our overseas members and their friends, many of whom, it is hoped, will be able to attend.

NEWS FROM THE SECTIONS.

BRISTOL AND SOUTH WALES.

This Section opened its fourth session on October 6 at Bristol University, when Mr. C. J. Waterfall, chairman of the Section, presided over an excellent attendance. Mr. R. Robertson read a paper on "The Gas Industry."

In a brief historical *résumé* the author stated that the term "gas" was apparently first applied to coal gas by Van Helmont, of Brussels, who, in 1600, found that coal when heated "did belch forth a wild spirit or breath" which he named "Gaz." A notable figure in the history of the industry was Windzer, who projected a company to illuminate London, and proposed the imposition of a tax on the burning of crude coal. The industry had made great progress since then, and there were now 1580 British undertakings, employing a total capital of £150,000,000 and paying £2,250,000 in local rates.

The introduction of electric lighting did much to stimulate the gas industry, but it was the use of the incandescent mantle which restored gas to the front rank of illuminants. Owing to the development of the internal-combustion engine, the cooking stove and the gas fire, the illuminating property of gas had become of secondary importance to the heating property, although this had only recently been officially recognised in the Gas Regulation Act of 1920. It was not generally well known that the gas industry was largely under State control; conditions relating to the raising of capital and the payment of interest thereon, quality of gas, and price were now all defined by statute. The history of gas lighting in Bristol dated back to 1811. The Bristol Gas Co. had now a capital of £1,900,000, 72,700 consumers, and paid £200,000 per annum in wages and £27,000 in rates and taxes.

Mr. Robertson then discussed the raw materials of gas manufacture, coal and oil, the difficulties arising from variations in the ash-content of coals, and recommended strongly that coal should be sold upon the basis of thermal value. He described various systems of carbonisation, purification, recovery of by-products, methods of measuring and testing gas, and of storage and distribution, and said that the distribution system of the three works of the Bristol undertaking consisted of about 400 miles of mains having a total capacity of almost 750,000 cub. ft. Demands on mains and services in Bristol had grown to an extent undreamed of a few years ago, and difficulties had been increased by the designing of houses, etc. by those who were more concerned with economy than efficiency.

On the subject of coal conservation the author emphasised the point that our industrial position was largely the result of a plentiful supply of cheap coal. Various inquiries instituted by Government Departments had shown that the burning of raw coal in open fires was, from the national standpoint, both wasteful and harmful. Of the 40·5 million tons of domestic coal consumed annually in the United Kingdom about 34 millions were wasted, and in addition 6 per cent. of the total coal, or 2,430,000 tons, was lost as soot, and the effects upon property, vegetation and national health called for drastic and immediate remedy. The best remedy was to carbonise the coal. The average thermal efficiency of ordinary carbonising plants was estimated at not less than 75 per cent., and on this basis the 40·5 million tons used for domestic heating could be replaced by 16 million tons, if carbonised according to the best modern practice. Compared with this the "super" power-stations recommended by the Commission on Coal Conservation would require 42 million tons, on the assumption of a degree of efficiency which could only be attained by gasifying low-grade coals in producer-gas plants.

MANCHESTER.

The opening meeting of the session was held on October 7 at the Textile Institute, with Dr. E. Ardern in the chair. The membership of the Section is fully maintained, and the very excellent attendance at the meeting was doubtless due to some extent to the exhibition of chemical products and accessories promoted by the Section and arranged by Messrs. L. G. Radcliffe, T. Horner, J. Hübner, and T. R. Wollaston. In order of the stands, the exhibitors were:—Orme and Co., Ltd., T. and C. Clark and Co., Ltd., Mr. T. R. Wollaston, Baird and Tatlock, Ltd., The British Thomson-Houston Co., Ltd., White's Injectors, Ltd., George Kent, Ltd., F. Davidson and Co., The Chemical Engineering Co. (Manchester), Ltd., F. Bamford and Co., The British Drug Houses, Ltd., The Lennox Foundry Co., Ltd., Mr. J. Drummond-Paton, The Cambridge and Paul Instrument Co., Ltd., Joseph Crosfield and Sons, Ltd., The Thermal Syndicate, Ltd., Mr. E. H. Marsh, and the Edison Swan Electric Co., Ltd. So successful was the exhibition that even greater efforts will probably be made next year.

Dr. E. Ardern, in his address on "The Disposal of Waste Liquors," discussed the position of the manufacturer in relation to the pollution of rivers by waste effluents and to local authorities. The pollution of rivers is now controlled by various local bodies and by riparian owners, but the appointment of a central Rivers Authority and subordinate additional Rivers Boards is urgently required. Such an authority could not only secure more uniform treatment of manufacturers in respect of the character of waste liquors discharged, but also ensure improvements in the watercourses of industrial areas without handicapping the chemical industry. The formulation of a legal standard defining a polluting liquor is both undesirable and impracticable, and the question of pollution is best dealt with by ascertaining the effect on the watercourse itself.

The legal position of the local manufacturer who desires to discharge trade waste into the sewers is not very clearly defined. In certain cases waste is admitted without any control or special charge; in others varying charges are made and preliminary treatment required. Local authorities should have power to prohibit the discharge into sewers of waste liquors that might affect the health of workers in the sewers, create serious nuisance, or disorganise the sewage purification plant. Provision should be made for regulating the equalisation of flow, limitation of temperature, maximum content of suspended solids, and acidity. Special charges for the reception of trade effluents into the sewers should be made only in certain cases, but penalties should be imposed when the preliminary purification plant is inadequately controlled. In conclusion Dr. Ardern urged that the disposal of waste liquors should be considered as an integral part of any manufacturing problem, and contended that a closer study of the nature of the waste liquor would assist materially the more efficient control of the manufacturing process itself.

GLASGOW.

The opening meeting of the session was held on October 17 in the Institute of Engineers and Shipbuilders, Glasgow. Mr. J. H. Young, chairman of the Section, presided, and in his opening remarks referred to the present session as a very important one, in view of the fact that the next annual meeting of the Society was to be held in Glasgow. He urged members of the Section to do all in their power to strengthen the position of the Society in Glasgow and to encourage students to join the Section under the new rules for admission of student associates.

Prof. G. G. Henderson then addressed the meeting, and, in directing the attention of the members to the remarkable, and almost revolutionary, discoveries of the past few years, said that chemistry was entering upon a new epoch in which many of the old fundamental principles of the science would have to be remodelled. During these few years the atomic theory had been established without doubt and was now a statement of fact. The existence of isotopes explained why the atomic weights, as known, were not whole numbers, and the work of Rutherford on the disruption of the nitrogen atom showed that the once-cherished dream of the transmutation of elements was now a reality—at any rate in the case of the lighter elements. Reference was made to the enormous amount of intra-atomic energy which had not yet been brought under control.

Prof. Henderson then described how the development of chemistry, especially physical chemistry, had influenced and modified the methods used by the industrial chemist. The study of the Phase Rule, and especially the study of the heterogeneous equilibrium between salts and their aqueous solutions, had made possible the manufacture of ammonium nitrate on the large scale required by the war. Investigations on the colloidal condition of matter—begun by Graham in Glasgow—had now practical bearing on many of our industries, such as in the treatment of cellulose and its products, the tanning of hides, the preparation of paints and varnishes, the making of bread, the manufacture of dairy products, and in the practice of agriculture. The study of catalysis had its application in increasing the world's supply of synthetic nitrogenous products from 10 per cent. of the total quantity—natural and artificial—in 1913 to 43 per cent. in 1920. Thus it was clear that chemists had entered upon a period in which there was a new philosophy of chemistry that was closely connected with chemical industry.

Dr. Longstaff, the General Secretary, gave an account of the annual meeting held in Canada and discussed the general arrangements for the next year's meeting in Glasgow. When the annual meeting was last held in Glasgow an American was in the chair, and at the coming meeting a Canadian would preside. He emphasised the point that the new student associates were expected to become full members at the earliest opportunity.

Dr. J. A. Cranston, the local secretary, reported that several suggestions had been received from members, and that they would be considered by the committee.

MEETINGS OF OTHER SOCIETIES.

THE CERAMIC SOCIETY.

The autumn meeting of the Refractory Materials Section was held on October 6 and 7 at the Institution of Mechanical Engineers, S.W. The president, Lt.-Col. C. W. Thomas, took the chair, and there was a large attendance of members.

A paper by Mr. H. Dewey on "The Refractory Materials of the London Basin" having been taken as read, Mr. J. H. Marlow gave an account of "The Marlow Gas-fired Tunnel Oven," the essential features of which are a simple and effective producer, arrangements for preheating the air and superheating gases before combustion takes place, and an exhaust (a system of pipes) that draws the heat through the centre of the tunnel and not along the walls.

In a paper on "Combustion of Fuel Oil" Mr. P. J. Woolf discussed the composition and general properties of petroleum fuel oil, and the relative advantages and disadvantages of the spray and vaporiser methods of burning. He drew attention to the Sklovsky's method (U.S.P. No. 1,229,338) of vaporising and mixing the oil with air prior to entering the tunnel oven, and described the oil-gas continuous compensating furnaces or tunnel kilns produced quite recently by the General Combustion Co. under the Kirk patents. This type of furnace is adaptable for long-continued heating cycles, including firing of firebricks, ceramic products, and annealing of sheet steel, steel and iron castings, etc.

A paper by Dr. A. Granger relating to corundum, and especially alumino-thermic corundum, was taken as read. Canadian corundum, the author states, when mixed with china clay gives very satisfactory crucibles, which after heating to cone 26 can be immersed in cold water without cracking. Alumino-thermic corundum contains iron aluminate as the result of molten alumina combining with unchanged ferric oxide in the Goldschmidt reaction; it is useful for making crucibles, tubes, etc., and for these purposes it should be freed from powder by fine-screening.

Mr. H. S. Houldsworth read a very comprehensive paper by himself and Prof. J. W. Cobb on "The Reversible Thermal Expansion of Silica," in which are recorded observations and conclusions on the changes undergone by the silica in "vitreosil" (silica glass), Meanwood ganister, quartzite, flint, and silica brick, when heated through various temperature ranges.

A "Symposium on Gas-firing," in which the chairman, Sir Arthur Duckham, Dr. E. W. Smith, and others took part, brought the proceedings to a close.

SOCIETY OF GLASS TECHNOLOGY.

The first meeting of the session was held at Sheffield University on October 9, Dr. M. W. Travers presiding.

The first paper was by Mr. G. V. Evers on "The Comparative Compositions of Pot Clays from the Stourbridge District during the last 50 Years." The author has found that the pot clay obtained to-day contains relatively less silica and more alumina than the clays of 30—50 years ago, but its refractoriness is in no way inferior; therefore the complaint of inferiority is hardly justified. Failure in pots to-day is due largely to the higher temperatures used and the increased duty put upon them. To improve the quality of his material, the manufacturer of refractories needs the active co-operation of the user and better information concerning particular requirements.

The paper on "The Properties of the Lime-Magnesia (Dolomite Lime) Glasses and their Commercial Application," by Miss V. Dimbleby, Messrs. S. English and F. W. Hodkin, with Prof. W. E. S. Turner, was read by the last-named. The use of magnesia in small amount together with lime produces a glass which is more fluid and much more easily melted than the corresponding lime or magnesia glass; and owing to the lower annealing temperature and reduced thermal expansion of the glass, annealing is easier and less fuel is required for the lehrs. Before such glasses can be manufactured, a supply of a suitable magnesian or dolomitic limestone must be found; as yet no such material sufficiently low in iron, say 0·1 per cent., is available. In the discussion, Mr. W. J. Rees stated that he had examined the majority of magnesites and magnesian limestones obtainable in this country, but was unable to suggest a suitable source. Greek magnesites were too expensive for use in the glass industry.

INSTITUTION OF GAS ENGINEERS.

The fifty-eighth annual meeting of the Institution of Gas Engineers, postponed from May last, was held at Westminster on October 10 and 11. The president, Mr. T. Goulden, in his opening address, remarked that as a result of the findings of Departmental Committees set up by the Board of Trade under the Gas Regulation Act the gas industry was free to develop without the hindrances to progress which would have accompanied the legal imposition of limitations to the inert and carbon-monoxide contents of town's gas. The coal stoppage had forced an expenditure of £3,000,000—£4,000,000 upon the gas industry.

Sir George Beilby's paper on "Steaming in Vertical Gas Retorts," already published (*cf.* J., 1921, 333 R), was read in abstract by Dr. C. H. Lander. A report on recording calorimeters was presented by the Research Sub-Committee of the Gas Investigation Committee, which has studied the possibilities of the Simmance recording calorimeter, and compared the results obtained with it with those of the Beasley recorder. Neither instrument is satisfactory for determining monetary charges or penalties under the Gas Regulation Act. Prof. J. W. Cobb presented the sixth report of the Gas Investigation Committee concerning the manufacture of blue water gas. Details are given of the thermal and chemical efficiencies of manufacture as normally practised in a plant erected in 1917 for the Birmingham Gas Department by Messrs. Humphrey and Glasgow. The average efficiency of production of water gas was 46 per cent., allowance being made for fuel used for supplying steam to the generator and for driving the blower. Omitting fuel for raising steam, the thermal efficiency of gas production averaged 56 per cent. The report of the Refractory Materials Research Committee dealt with jointing materials for refractories and with the influence of oxidising and reducing atmospheres on refractory materials. Of the mixtures of fireclay with fireclay grog examined for use as jointing materials, those composed of mixed grades of clay and grog gave the best results in practice. Reference is made in the report to the possible deposition of graphitic carbon upon fireclay surfaces heated in an atmosphere of coal gas. Other reports presented related to the life of gas meters and the external corrosion of mains and services.

Mr. G. M. Gill, in a paper on "Carbonisation in Horizontal Retorts," detailed results obtained with the existing plant of the South Metropolitan Gas Co. A system of inspection, necessitating the whole-time attention of six inspectors for a period of 6 weeks, and involving examination of 42 points in connexion with a system of 2900 retorts, has resulted in increased efficiency in operating the plant. The cost of the inspections averaged about ⅓d. per ton of coal carbonised. At one works the percentage of inerts contained in the gas has averaged only 9 per cent. In a paper on "The Liberation of Nitrogen from Coal and Coke as Ammonia," Mr. A. C. Monkhouse and Prof. J. W. Cobb gave a detailed study of the effect of atmosphere upon the yield of ammonia in the thermal treatment of coal. The results indicate that at 800° C. up to about 80 per cent. of the nitrogen content of coke is recoverable as ammonia by submitting the coke to the successive action of nitrogen, hydrogen, and steam. A descriptive paper dealing with plant for tar-distillation and the manufacture of sulphate of ammonia was submitted by the Society of British Gas Industries.

On October 13 members paid a visit to the works of the South Metropolitan Gas Co. at East Greenwich. Dr. Charles Carpenter, referring to the company's new charter, said that increasing competition made it essential for officials connected with the gas industry to be thoroughly equipped for their various duties, and he drew attention to a provision in the charter which necessitated the appointment to the directorate of persons possessing the requisite scientific, technical, or commercial qualifications.

SOCIETY OF DYERS AND COLORISTS.

At the opening meeting of the West Riding Section, held at Bradford on October 20, a lecture was delivered by Mr. J. F. Briggs on the "Dyeing of Acetyl Silk." This new artificial silk, now first coming on the market in commercial quantities, it was stated, consists of cellulose acetate, and therefore differs in many important respects from the familiar types of silk composed of hydrated cellulose. As a cellulose ester of low degree of hydration, the new silk, without being absolutely impervious to water, is only very slightly softened by it and retains, after whizzing, only about 30 per cent. of water calculated on its dry weight. Owing to this property it resists mechanical treatment when wet, *e.g.*, in the operations of milling, laundering and wringing. The new silk also possesses high insulating qualities which are particularly valuable from a hygienic point of view. The impression that this ester-silk cannot be dyed was based on experimental observations made with the German products of some years ago, and is not correct for the British article of the present day. As a matter of fact the dyeing of this silk is not more difficult than that of any other artificial silk; it is only somewhat different, and dyestuffs of different constitution are generally employed. Thus, just as the dyer has been accustomed to classify dyestuffs as wool dyestuffs and cotton dyestuffs, so he will now recognise another classification under the heading of cellulose-acetate dyestuffs.

Practically, there are two general methods of dyeing this silk, namely, the partial saponification method which consists in transforming a regulated proportion of the ester back into cellulose and dyeing that with the ordinary cotton dyestuffs, and, secondly, the direct method, in which advantage is taken of the chemical affinities of the ester itself, which is dyed directly by selected dyestuffs of sympathetic constitution.

Dealing with the older method first, the lecturer described how the saponification of the silk with 10 per cent. of its weight of caustic soda at 75° C. could be regulated so as to produce an outer layer of about 20 per cent. of regenerated cellulose, leaving an inner core of 65—70 per cent. of totally unaltered cellulose acetate soluble in acetone. By this saponification process any of the familiar cotton dyestuffs can be applied to this silk without difficulty.

The saponification method, however, is regarded more or less as a temporary expedient, and the direct method will ultimately supersede it, since by it all the chemical properties of the cellulose ester are preserved unchanged. The process of dyeing without chemical modification of the silk has been highly developed, particularly by R. Clavel, of Basle, Switzerland, in which country the remarkable properties of the finer counts of the ester-silk are highly appreciated by the ribbon weavers. Practically all the basic dyestuffs can be easily dyed and fixed without mordants, owing to the attraction exerted by the acetyl groups of the cellulose ester upon the dyestuff base. For a similar reason all the dyestuffs of the Gallocyanin group have a direct affinity for the fibre. Many of the azo wool-dyestuffs give full and fast shades, especially those representatives which contain no sulphonic acid groups, for instance many of the Metachrome and Azochromin series. Alizarin dyestuffs can also be used without mordants. Probably the most remarkable results and the most far-reaching possibilities are those afforded by the method of developing the azo-dyestuffs in the fibre. All the primary amines and simple amino-azo compounds are absorbed with avidity by the acetylcellulose and fixed in the fibre so that the excess can be rinsed off. The absorbed base is then diazotised *in situ*, and the dyestuff developed by coupling with an alkali phenolate or naphtholate, or with another base which itself can be diazotised and coupled.

The lecturer showed specimens of dyed acetyl silk in yarns ranging from 75 to 300 deniers and in the form of knitted fabrics, both dress and hosiery goods, and Swiss ribbon fabrics. In the ensuing discussion it was confidently stated that British dyers are willing and able to dye the new ester fibre in any shade and any degree of fastness required.

THE CHEMICAL SOCIETY.

At the ordinary scientific meeting held on October 20, Sir James Walker, presiding, four papers were read, of which one, that on chenopodium oil, by Dr. T. A. Henry and Mr. H. Paget, was of direct importance to applied chemistry. The oil in question is used in the tropics as a remedy for hookworm, and has been repeatedly examined since 1908, but the cause of its anthelmintic properties still remained uncertain. The authors have found that the constituent of value for the treatment of hookworm is ascaridole, and that the hydrocarbon content, when pure, as well as the products of decomposition of ascaridole by heat, are quite inactive in this respect. The hydrocarbons present in chenopodium oil are *p*-cymene, α-terpinene, and a new terpene, which is probably a dihydro-*p*-cymene boiling at 177°—178° C. and yielding a crystalline tetrabromide of m.pt. 117° C. Minor constituents of the oil are butyric acid and methyl salicylate, but no evidence was found of the presence of sylvestrene, safrole, camphor, or phellandrene.

Mr. P. Blackman described a new differential method of determining molecular weights, depending on a difference in vapour pressure of two solutions and the increase of volume of each by condensation of the vapour of the solvent. Various forms which the apparatus might take were indicated, but none of them appeared to give complete satisfaction.

Prof. F. L. Pyman and Mr. R. L. Grant presented a paper on nitro- and amino-derivatives of 4.phenyl-glyoxaline, and it was pointed out that the reactions involved were possibly connected with similar reactions of importance in physiology.

Dr. G. K. Ingold (with Mr. W. J. Powell) discussed the equilibria of the Michael reaction, showing that in certain cases temperature had a marked influence on the point of equilibrium.

NEWS AND NOTES.

FRANCE.

Industrial Notes.—*Chemical Industry.*—One of the chief events of the past few weeks has been the revision by the High Court of Alsace-Lorraine of the finding of the Mulhouse Court by which practically all the Alsatian potash mines would have passed under German control. Another important event was the meeting organised by the Société de Chimie Industrielle, a report of which will appear in an early issue of this *Journal.*

It is announced that the great Chauny works, upon the reconstruction of which 50 million francs has been expended since January, 1919, will be in full operation in about six months' time.

Metallurgy and Coal.—The metallurgical market continues to improve, and following several important foreign orders for pig iron a few extra blast furnaces are to be blown in. Important orders for semi-finished products have also been received. That a revival is at hand is also shown by the increased tonnage of iron ore which is being produced in the Meurthe and Moselle and the Briey districts.

Coal supplies are increasing in the North of France. Of the 1,064,000 metric tons of coal imported in August, 371,000 t. came from England, 224,000 t. from Belgium, 85,000 t from America, and 362,000 t. from Germany. The maintenance of the supply from America is considered remarkable in view of the adverse exchange and the relatively poor quality of the coal.

Colonies.—Colonial development is again being discussed with a view, not only to develop the supply of raw materials for home industries, but also to find new markets for French goods. It is reported that an American company with a very large capital is being formed to mine the gold in French Guinea, which has hitherto been worked to a small extent by the Compagnie Française de Maratoni and the Société d'Exploitations Aurifères. The former of these companies began operations in 1914, and has produced slightly over 1000 kg. gold; the latter delivered 467 kg. fine gold to the Banque de France in 1912. Lack of capital is the chief cause of this small production and not the absence of gold, which, according to experts, occurs in large quantities.

The olive-oil industry in Morocco, it is thought, would readily respond to the adoption of more up-to-date methods. The yield of oil from fresh olives, which is now about 20 per cent., could be raised considerably, and the fat content of the press-cake (10—18 per cent.) could be recovered by solvent extraction.

The projected colonial exhibition to be held in Marseille in 1922 is already attracting attention.

Synthetic-Ammonia Manufacture.—The report of the French commission which has been investigating the Haber and Claude processes is not to be published, but it is inferred that a decision in favour of the latter has been reached, because it is announced that the Compagnie Nationale de l'Azote, which owns the French rights of the Haber patents, will be liquidated shortly. If this is so the manufacture of synthetic ammonia in France will be confined to the Société de la Grande Paroisse, which uses the Claude process.—(*Chem. Ind., Oct.* 3, 1921.)

CANADA.

The Glue Industry in 1918.—Glue and mucilage were manufactured in Canada in 1918 by 11 firms (5 in Ontario, 4 in Quebec, 1 in New Brunswick, and 1 in Nova Scotia), representing a total capital of $816,420. Materials used by the industry cost $812,923, including $397,552 for glue stock, a large part of which was obtained as a by-product of the tanning industry, and the products manufactured were worth $1,465,163. Imports of liquid glue, mucilage, etc., were valued at $246,674, and imports of sheet or powdered glue amounted to 396 tons.

JAPAN.

The Mineral Industry.—The value of the total output of ores and minerals in 1920 declined by 11·5 per cent. to £57,859,635. With the exception of gold, platinum, mercury, iron pyrites, sulphur, and pitch outputs showed considerable decreases. The production of the chief minerals, together with the percentage increase or decrease compared with 1919 were as follows:—Pig iron 165,354 long tons, −19·3 per cent.; copper 65,572 t., −13·6 per cent.; gold 247,863 oz., +6·1 per cent.; coal 28,660,476 t., −6·5 per cent.—(*Bd. of Trade J., Sept.* 15, 1921.)

UNITED STATES.

Petroleum Discovery in the Philippine Islands.—The Bureau of Commerce and Industry of the Philippine Islands has reported that an excellent showing of very light oil has been discovered near the Canguinsa River, in the Bondoc region of the islands.—(*U.S. Com. Rep., Sept.* 5, 1921.)

Matching the Colour of Plaster.—It is often important to be able to match exactly the colour of a gypsum plaster, and it has been found that the spectrophotometric method of colour comparison devised by Priest, of the Bureau of Standards, can be used for this purpose. Two blocks, a sample and a standard, are evenly illuminated and placed so that the field of the spectrophotometer is lighted partly by the standard and partly by the sample. On rotating the Nicol prism one half of the field increases in brightness as the other darkens, and when the halves match the position of the prism indicates the relative quantity of light reflected from the sample and from the standard. Tests can be made with any desired wave-length of light, and tints may be expressed numerically by determining the ratio of reflexion of blue and yellow light.

The Camphor Industry.—In the *Revue des Produits Chimiques* M. A. Dubosc urges the French Government to develop camphor plantations in Tonkin, and quotes the recent expansion of camphor cultivation in the United States and the Philippine Islands. The initial steps were taken by American celluloid manufacturers, but last year several companies were formed to exploit camphor plantations, and the Department of Agriculture is keenly interested in the industry. The first camphor farm to be established, at Satsuma Heights in Florida, has placed 10,000 lb. of camphor on the market since the beginnning of the year, which is said to be equal in all respects to Japanese refined camphor. Two companies operating in Florida are said to possess estates of about 2500 acres each, and a third has obtained concessions in Texas for establishing a large camphor forest. Camphor plantations do not become productive in less than 40 or 50 years. The Japanese Government is attempting to replace in Formosa the camphor forests that have been destroyed by over-exploitation, but by the time the Japanese schemes become productive the United States will be independent of Japanese supplies, if the present policy is maintained.

The Oil, Paint and Drug Reporter of September 5 reports that in evidence given before the State Finance Committee on the Fordney Tariff Bill the chairman of the Monsanto Chemical Works said that if a 25 per cent. *ad valorem* tariff were placed on camphor imported into the United States the company would produce within a few months sufficient synthetic camphor to render importation unnecessary. In 1920 the company began to erect a synthetic-camphor plant to use a German process, but owing to trade depression work was suspended after $425,000 had been spent upon it. A further $1,000,000 was needed to complete the plant, but, given protection during the development stage, the project would be carried through.

Magnesite in 1920.—The production of magnesite in the United States in 1920 was 303,767 short tons, valued at $2,748,150, which represented an increase of 94 per cent. in quantity and 120 per cent. in value over the figures for 1919. Washington is the chief producing State, followed by California, where the high cost of labour, supplies and transport have reduced the demand. Seventy per cent. of the Californian magnesite was used as plastic material, and the output from Washington was practically all sold for refractory purposes in the form of synthetic ferromagnesite. The total consumption in the United States in 1920 was 366,877 t., calculated as crude magnesite, of which approximately three-quarters was used for refractories. Imports of crude magnesite rose to 48,332 t., of which Italy supplied 49 per cent. (presumably magnesite from Radenthein, Austria), Canada 14, Greece 9·3, and Czechoslovakia 8·9 per cent.—(*U.S. Geol. Surv., July* 27, 1921.)

Magnesium in 1920.—Only two companies, the American Magnesium Corporation, Niagara Falls, and the Dow Chemical Co., Midland, Mich., produced magnesium in the United States in 1920. For some years past the former company has been the largest producer and has marketed its output of magnesium metal in both stick and powder form, only a very small proportion having been sold as alloys and castings. The latter company produced only stick magnesium in small quantity, largely for experimental work on various automobile and aircraft parts. From the end of 1920 up to June, 1921, the manufacture of magnesium in the United States was practically suspended, and the plants were operating solely for experimental purposes. This was due to the importation of magnesium from Europe at a price with which the domestic producers could not compete. Imports in 1920 amounted to 29,275 lb., worth $25,055, or 85 cents per lb.; the average price for the domestic product was $2·75 per lb. for powder and $1·60 per lb. for stick magnesium.—(*U.S. Geol. Surv., Aug.* 18, 1921.)

SOUTH AFRICA.

Mining in Southern Rhodesia in 1920.—The report of the Secretary of Mines for 1920 states that the mining industry had to encounter many difficulties during the year owing to the high cost of supplies, fuel, and transport, and to unrest among the white employees. The output of minerals in 1919 and 1920 was as follows:—

		1919.	1920.
Gold	oz.	593,222 ..	552,498
Silver, ...	„	145,982 ..	158,982
Asbestos	tons	9,799 ..	18,823
Mica	„	6 ..	97
Chrome ore	„	35,282 ..	60,269
Copper	„	3,012 ..	3,108
Wolfram	„	— ..	17
Arsenic	„	242 ..	437
Coal	„	510,040 ..	578,492

Mica of good quality was found over a larger area than had been anticipated, and thanks to the use of improved methods of sorting and grading some of the material realised high prices on the London market. A steady supply of chrome ore was shipped during the year, and there would be no difficulty in sending much larger supplies to Europe if the demand arose, as valuable deposits have been proved in certain districts. Unless the demand for chrome ore increases appreciably there is little doubt that many claims will be abandoned.—(*Bd. of Trade J., Sept.* 1, 1921.)

New Treatment-Method of Gold Ore on the Rand.—Metallurgists concerned with the treatment of gold ores will be interested in watching the outcome of the change of method recently decided upon by the Springs Mines Co. (Transvaal). In extending the capacity of the reduction plant, the directors have decided to discard the stamp mill and amalgamation battery and adopt "all sliming" in tube mills and direct cyanidation. Results of experiments have shown that a standard 22 ft. × 5 ft. 6 in. tube mill can economically handle a much coarser feed (such as is obtained by single-stage breaking in gyratory crushers) than has hitherto been furnished by stamps, and that the finer comminution of the ore, permitting direct cyanidation by agitation, results in an increased extraction of the gold content, a saving in capital expenditure, and probably in operating costs.

GENERAL.

Streatfeild Memorial Lecture.—The 4th annual lecture was delivered on October 20 at the Finsbury Technical College by Mr. W. P. Dreaper on "Chemical Industry, a branch of Science." It was held that industry is and always has been a branch of science, that in its early stage it represented existing experimental science, and that modern research naturally developed from it. This agreed with the suggestion that knowledge was only complete when it reached the stage of usefulness. The terms "pure" and "applied" were discarded by the lecturer, and discovery was divided into two parts which were static or dynamic as they fell short of, or reached the stage of, usefulness. There were 400 millions of the world's workers who were still working without scientific supervision, and at least 80,000 chemists were required for this purpose. If these increased efficiency by an all round 10 per cent. their work would be the equivalent of an extra army of 40 million workers. Chemical industry as a branch of science must be organised on scientific lines if it is to be efficient and progressive. Industry was science with its coat off. Chemists must have full representation on the boards of industrial companies and every aid must be secured to increase the influence of science, which should be directly represented in the House of Commons.

Examples were given of research started in this country which under our inefficient system was abandoned here and brought to an economic stage elsewhere, where the necessary organisation and financial support were forthcoming. One example was the manufacture of synthetic ammonia, the earliest work on present lines having been initiated in this country in 1881, and actually demonstrated before the Chemical Society by G. S. Johnson. Subsequently Ramsay and Young repeated this work, using pressure. At a later date Nernst undertook his work with 70 atmospheres pressure, then Haber worked up to 200 atmospheres and made economic production possible, and the latest development was the use of 1000 atmospheres by M. Claude. The question of support by the banks was discussed, and a scheme suggested which would be feasible under conditions obtaining in this country.

The Chemical Industry Club.—The annual meeting of the Club was held at Whitehall Court on October 17, Prof. W. R. Hodgkinson presiding. The report of the committee showed that notwithstanding the prolonged industrial depression, the membership had been well maintained, 690 members being on the books. In view of the leanness of the times no great effort was made to increase the membership, but it is expected that much more will be done during the current year; there is still plenty of accommodation, and it is hoped that chemists of all shades and descriptions will rally to the Club and set the seal of final success upon its endeavours. The gratifying balance of over £150 on the year's working should be useful in assisting the committee's "forward" policy. The present officers were reappointed, Mr. W. Cullen was elected assistant hon. secretary, four vacant seats on the committee were filled, and a very hearty vote of thanks was accorded to Prof. Hodgkinson, who now retires from the chair, for valuable services rendered. A big attendance is expected at the third annual dinner, to be held at the Connaught Rooms, W.C., on Friday, November 18; those who require tickets (15s., exclusive of wine) should apply without delay to the hon. secretary at 2, Whitehall Court, S.W. 1.

Research in the Colonies.—A committee was appointed in November, 1920, by Lord Milner, then Secretary of State for the Colonies, "to consider and report what steps can be taken to secure the assistance of the Universities of this country in carrying out the research work which is essential to the protection of the inhabitants of the Colonies and Protectorates from disease, and to the successful development of their veterinary, agricultural and mineral resources." The committee's report (Cmd. 1472. 2d.), dated August, 1921, states that the suggestion was made to it that the best means of accomplishing the desired end was to establish a Colonial Research Service, and that this proposal was rejected without hesitation. Instead, it made two recommendations. The first is that British teaching organisations of university standing should encourage post-graduate study and provide further facilities for the training of students in the principles and methods of research, with a view to increasing the number and improving the quality of the candidates for scientific appointments in the Colonies and Protectorates. It is pointed out that if students were informed of the "numerous and lucrative appointments" which the Colonies offer to men adequately equipped by post-graduate study, this would in itself be an inducement to students to seek such training.

Attached to the report is a statement showing the number of such appointments available, with some particulars as to salaries and conditions of service. From this it appears that the only appointments for research chemists are in connexion with Departments of Agriculture; there are also 18 appointments for analytical chemists, but it is not quite clear why they should be included as these positions rarely afford opportunities for anything that would be regarded as research by University authorities. So far as chemists are concerned the appointments are not exactly "numerous," and it is not possible to say whether they are "lucrative," as the table for appointments as analytical chemists is the only one printed without salary headings.

The second recommendation is that the scientific staffs of Universities should be appealed to for assistance in researches of exceptional complexity and in the supply of highly-trained investigators to deal with pressing emergencies. These recommendations, the committee realises, mean additional funds for the establishment of new Chairs and the enlargement of University staffs. As the Colonies and Protectorates are unable to provide the necessary funds it is suggested that these might be secured by appeals to local patriotism.

The report is signed by all the members of the committee, but there are reservations by Sir Stewart Stockman and Sir Walter Fletcher. The latter points out that the second recommendation is too vague to be practical and that some organisation is required to assist the Colonial Office in making its appeal to the appropriate quarter, and in co-ordinating the results of research. This reservation is commented on in a Colonial Office letter printed as an annexure to the report, in which it is mentioned that expert bodies for the organisation and co-ordination of the contemplated research already exist in the Imperial Bureaux such as those of Entomology, Mycology, and Mineral Resources, and in the various expert committees appointed by the Secretary of State to assist him in connexion with problems of tropical medicine, etc.; and that, in fact, the organising machinery already created needs simplification rather than extension, and that this matter is already receiving attention. A curious feature of the report is the omission of any reference to the Imperial Institute, though the latter is administered by the Colonial Office and has as one of its chief functions the investigation of colonial products with a view to their industrial utilisation. If the committee's second recommendation is carried into effect there will be considerable risk of overlapping, not only with the activities of the Institute, but possibly also with the work of some of the Industrial Research Associations, since the latter may be interested from time to time in raw materials of colonial origin.

The Logwood Industry in Jamaica.—Although logwood was first introduced into Jamaica in 1715, but few attempts have been made to cultivate the tree and most of the wood cut is from self-sown trees growing on waste lands unsuitable for cultivation. Until quite recently the production of logwood crystals was very remunerative, as the raw material costing £40 made a ton of crystals worth £200 in London. An association of logwood producers has been formed in order to obtain higher prices, but meantime the demand for both wood and crystals has declined to such an extent that the local factories have had to close down. Extract is produced at two plants in Jamaica, viz., Spanish Town and Lacovia, with a minimum crushing capacity of 20,000 and 12,000 long tons per annum, respectively; the plant at Savanna-la-Mar was destroyed by fire shortly after completion. In 1919 the United Kingdom imported logwood extract worth $1,614,704, and the United States imported 9314 t. of the wood ($228,087) and 51 t. of the extract ($19,788). Crystals are always shipped in 320-lb. casks and liquid extract in 650-lb. barrels. It requires from 8 to 9 t. logwood to produce 1 t. of crystals and a slightly smaller amount to produce 1 t. of liquid extract.—(*U.S. Com. Rep., Aug.* 25, 1921.)

The German Nitrogen Industry.—During 1920 Germany exported only 747 metric tons of calcium cyanamide and other nitrogenous fertilisers, and of this quantity 75 t. was shipped to Dantzig, 439 t. to the Saar region, 50 t. to Switzerland, and 184 t. to other countries. The smallness of this trade was due to the restrictions placed upon exportation by the Chemical Export Bureau (Aussenhandelstelle Chemie) in Berlin. Exceptions, however, were occasionally made in favour of agricultural interests. Minimum prices for export were not fixed for the first half of 1921, and the prohibition of the import of foreign nitrogen compounds was continued. According to a Ministerial report the internal trade in nitrogen products has been good, owing to the exhaustion of stocks. Proceeds, however, have not covered costs, and in consequence prices of nitrogenous fertilisers were raised by 15 per cent. as from July 1. The maximum price now in force for most nitrogenous fertilisers is 1450 pfg. per unit (1%) of nitrogen, excepting sodium nitrate, calcium cyanamide, and dried, ground ammonium sulphate, for which the maxima are 1750, 1290, and 1485 pfg. per unit, respectively, and the terms are f.o.r. at nearest German railway station, cash with order, and no discount.

To facilitate the provision and use of nitrogenous fertilisers inland, the Stickstoff-Kredit, G.m.b.H., was formed early in 1921 with a capital of 500 million marks, and incorporating many of the leading firms of chemical manufacturers. Credit is allowed chiefly to direct purchasers, such as manufacturers of fertilisers and traders, and only to a small extent to farmers who apply direct for supplies; the maximum credit allowed is 50 per cent. of the total value of the account, but interest at 2 per cent. above the bank rate is guaranteed on all cash payments made since June, 1920. In addition to this credit institution, two important new organisations have been founded this year for producing and distributing nitrogen products, viz., the Deutsche Salmiakgeistvereinigung, comprising the "Badische" and all chemical firms and gas undertakings that produce aqueous ammonia, and an "Interessengemeinschaft" comprising the whole of the nitrogen-products industry in Upper Silesia, in which the Oberschlesiche Kokswerke u. Chemische Fabriken A.-G. (associated with the Stickstoffkredit Ges.) plays a leading part.

Graphite in 1919.—The stimulus of war demands led to a general over-production of graphite which culminated in 1917 and was the cause of the lower prices and diminished output in 1918. After the armistice stagnation set in, and production was universally depressed, owing to cancelled orders and the sharp drop in prices. The world's production of natural graphite in 1913 and 1919 is set out below:—

	1913.	1919.
	Metric tons.	
United States:—		
Amorphous	2,035	3,065†
Crystalline	2,297	3,668†
Canada	1,961	1,199†
Mexico	4,023	4,995
Austria and Styria	17,282	17,000*
Bohemia and Moravia	32,175	31,234
France	1,194	375
Germany (Bavaria)	12,057	64,080‡
Italy	11,145	7,626
Spain	—	1,958
Sweden	88	—
Ceylon	28,996	6,504
British India	—	129
Japan	667	—
Korea	14,543	12,000*
Madagascar	7,997	2,000
South Africa	35	78
Australia	—	102

* Estimated. † Shipments and Sales. ‡ 1918.

Various new graphite deposits have been opened up, particularly in French Indo-China, where the Kwang-ngai deposits, in Annam, cover a zone extending westwards from the coast and over a breadth of 12—18 miles into Laos; in 1918, the production of amorphous graphite at Kwang-ngai was 15,000 metric tons. Deposits of flake graphite on the island of Senjenö, off Tromsö, Norway, are being developed by the A.S. Skaland Grafitwerk, of Bergen, but no data as to output are available.

In the United States the sales of domestic natural graphite in 1919 were 7422 short tons, valued at $778,857, a decrease of 43 per cent. in quantity and 49 per cent. in value compared with 1918. There were 20 producers, and Alabama was the chief producing State, followed by Pennsylvania and New York. The output of artificial graphite manufactured by the Acheson Graphite Co. at Niagara Falls, N.Y., was 4081 t. (4591 t. in 1918, 5237 t. in 1917). Exports of graphite were comparatively small, and consisted in 1919 of crude graphite 629 t. ($90,185), graphite manufactures worth $788,755, and pencils and pencil leads valued at $3,565,347. Imports in 1919 were 26,626 short tons ($2,978,096), of which Ceylon supplied 9451 and Madagascar 10,016 t., of the value of $1,530,281 and $1,205,350, respectively.—(*U.S. Geol. Surv., Feb.* 5, *July* 19, 1921.)

Gypsum Deposits in Ireland.—Large deposits of gypsum have been discovered at Knocknacran, near Carrickmacross, County Monaghan, and at Lishaboe, County Meath. The Lishaboe deposits, estimated to contain one million tons, are said to have been acquired by the Farney Development Co., Ltd., which is building a factory with a capacity of 25 tons of plaster of Paris per day. The company has also acquired large blocks of good alabaster.—(*U.S. Com. Rep., Aug.* 24, 1921.)

Kaolin and Ochre Deposits in Finland.—The kaolin deposits recently discovered at Puolanka, in Finland (*cf.* J., 1921, 313 R), contain at least 10,000 tons, and probably over 500,000 tons. Kaolin of excellent quality has also been found at four localities in Pihlajavaara in layers varying from 13 to 33 feet in depth. Deposits of red and yellow ochre occur in the Pihlajavaara district which are of good quality but of doubtful economic value.—(*U.S. Com. Rep., Aug.* 31, 1921.)

The European Ichthyol Industry.—To a large extent the war has broken the monopoly in the production of ichthyol formerly held by Austria, and principally by a single Austro-German firm, the Ichthyol-Gesellschaft Cordes Hermanni. Now, however, there are indications that this company is making every effort to recapture its former supremacy, but the Italian ichthyol industry is making rapid strides.

The deposits to which the name "icthyol shales" was originally given, are in the Tyrol at Seefeld, north-west of Innsbruck on the south slope of the Karwendel Mountains, which form the boundary between Austria and Bavaria. A tarry oil has been distilled by the Tyrolese peasants since the 16th century for use in treating wounds and sores, but the real commercial development of the deposits was begun when the Ichthyol-Gesellschaft Cordes Hermanni and Co., formed in Hamburg, commenced operations in 1891. The output, in metric tons, of this company's refinery at Maximilianshütte from 1909 to 1915 was as follows:—

	Ichthyol shale consumed.	Crude oil produced.	Refined oil produced.	Shipments to Hamburg
1909	524	49·9	30·8	26·4
1910	557	54·5	33·7	35·4
1911	1,263	82·8	49·5	49·5
1912	1,208	100	59·2	44·2
1913	937	87	*50	†
1914	302	*24	*15	†
1915	40	*3	*1·8	†

* Estimated. † No data.

On the German side of the Karwendel Mountains, shales similar to those of Seefeld are found in the valley of the Isar and its tributary, the Loisach. Exploitation of these shales was begun in 1920 by Oelschieferwerk Karwendel G.m.b.H., of Krunn, Upper Bavaria. In Switzerland, north of Meride on Lake Lugano, a deposit of shale has been worked for several years by the Società Miniere Scisti Bituminosi di Besano e Meride, which mined and distilled 440 metric tons of shale in 1915. The product from the Meride shale is known as "Saurol" and resembles ichthyol in its therapeutic properties. Ichthyol shales have been known in Italy for several years, and the Società Miniere Scisti Bituminosi de Besano e Meride extracted 2 tons of shale in 1913 from concessions in the communes of Besano, Viggiu, and Porto Ceresia adjoining the Swiss frontier. In 1914 deposits were mined in the province of Udine and in 1916, 11 tons of crude ichthyol oil was distilled. Experiments with ichthyol shales at Giffone Valle Piana in the province of Salerno were carried on in 1913 by the Società Industrie Chimiche "Ittiolo" with satisfactory results. In 1915 a retort furnace was built at Giffone Valle Piana and a chemical plant established at Naples; mining began in 1916 with an output of 100 metric tons of shale which was increased to 120 tons in 1917.

Since Dr. Unna first introduced ichthyol into therapeutics the valuable anti-parasitic properties of this substance have been widely recognised by the medical profession in the treatment of many skin diseases. The reddish-brown syrupy liquid which is put on the market is an ammonium salt of ichthyolsulphonic acid obtained by neutralising with ammonia the ichthyol-sulphonic acid obtained when the oil produced by distilling the ichthyol shale is treated with sulphuric acid. Ichthyol was not given a place in the 1914 edition of the British Pharmacopœia, but its general use in therapeutics would appear to warrant its inclusion in a future edition. —(*Oil, Paint and Drug Rep., Aug* 8, 1921.)

The Finnish Tar and Turpentine Industry.—The output of wood tar in Finland has greatly decreased of late years owing to high costs, the small demand, etc. In 1920 the production of stack and kiln tar was only 25,000 barrels (3750 metric tons), whereas the domestic consumption was about 10,000 barrels and exports 18,000 barrels. The turpentine industry has made considerable progress, and its output is now two or three times greater than before the war, the turpentine being distilled in the country instead of being exported in a crude state. Imports and exports of tar, turpentine, and related products in 1920 were as follows:—

	Metric tons.	
	Imports.	Exports.
Rosin	1,670	30
Asphalt, coal-tar	3,005	2
Wood-tar	2	2,717
Pitch, pitch oil	1,331	148
Turpentine	7	261

Very little rosin is produced in the country.—(*U.S. Com. Rep., Aug.* 18, 1921.)

PERSONALIA.

Mr. A. Chaston Chapman has been appointed a member of the Royal Commission on Awards to Inventors in place of Sir J. J. Dobbie, resigned.

Dr. F. C. Vilbrandt, of the Ohio State University, U.S.A., has been appointed associate professor of industrial chemistry in the University of North Carolina.

Dr. G. W. O. Howe, head of the Department of Electrical Standards and Measurements at the National Physical Laboratory, has been elected to the new James Watt chair of electrical engineering in the University of Glasgow.

In the University of London, Dr. W. B. Tuck has been appointed to the University chair of chemistry, tenable at Middlesex Hospital Medical School, and Dr. Paul Haas to the University readership in plant chemistry, tenable at University College.

Sir E. A. Brotherton, Bart., has given the sum of £20,000 to the University of Leeds for developing study and research in bacteriology. Sir Garrod Thomas, vice-president of the University College of Wales, Aberystwyth, is to give to the College farm property in Cardiganshire of the estimated value of £8,000, the income of which will be devoted to the encouragement of post-graduate work in chemistry and physics. The University of Glasgow and the Royal Technical College, Glasgow, are each receiving the sum of £10,000 under the will of the late Mr. W. J. Chrystal, chemical manufacturer.

Prof. H. von Euler-Chelpin, of Stockholm, has been offered the chair of applied chemistry in the Technical "Hochschule" at Munich, in place of Prof. Lintners, who has retired.

Dr. L. von Putnoky, extra-ordinary professor and director of the department of inorganic chemistry in the Technical "Hochschule" at Budapest, has been raised to the rank of ordinary professor.

We much regret to announce the death on October 17 of Mr. E. J. Bevan, aged 64, the colleague of Mr. C. F. Cross, and an original member of this Society.

GOVERNMENT ORDERS AND NOTICES.

Safeguarding of Industries Act.—The Board of Trade has issued a short list of corrections in the lists of articles subject to duty under Part I. of this Act. The lists are now being reprinted as corrected.

Coalminers' Lamps.—The Secretary for Mines notifies that he proposes to make regulations concerning the use of safety lamps in coalmines in accordance with a draft now issued, and that objections to the draft regulations must be sent to him within 30 days of October 10.

Inquiry into Rubber Industry.—The Colonial Secretary has appointed a committee, which includes representatives of rubber growers and manufacturers, "to inquire and report upon the present rubber situation in British Colonies and Protectorates for the information of the Secretary of State for the Colonies, and to advise what remedial measures should be taken to improve the existing situation."

PARLIAMENTARY NEWS.

HOUSE OF COMMONS.

Safeguarding of Industries Act: Synthetic Camphor, Blown Glass, etc.

Mr. Kiley asked the Prime Minister if he was aware that synthetic camphor, which was not produced in Great Britain, was now subject to a duty of 33 per cent. as a fine chemical under the Safeguarding of Industries Act, the effect of which would be to increase its price to home manufacturers of celluloid, whereas foreign celluloid was imported free. In reply Mr. Baldwin said that synthetic camphor was scheduled under the Act as a synthetic organic chemical, and the Board of Trade had no discretion to exclude from the operation of the Act any article covered by the schedule. He was not prepared to introduce legislation to suspend Part I. of the Act as far as it affected commodities not manufactured in Great Britain. —(Oct. 18.)

In answer to Sir T. Polson, Mr. Baldwin said that a duty of 33 per cent. was leviable on dolls' eyes when these were made of blown glass.—(Oct. 20.)

Mr. Young, in reply to Mr. Mosley, said that £7009 had been collected in duty between October 1—18 under Part I. of the Safeguarding of Industries Act. As no order had been made under Part II. of the Act, no duty was chargeable under this section.—(Oct. 20.)

Proposed Cotton-Bleaching Factory at Holton Heath.

Replying to Mr. Waddington, Com. Eyres-Monsell said that no further work would be done in connexion with the proposed factory until the Admiralty was absolutely satisfied concerning certain technical points which were being examined with the assistance of eminent chemists.—(Oct. 20.)

West African Palm Kernels.

Answering Mr. G. Murray, Mr. E. Wood stated that the continued trade depression in the West African Colonies was not mainly due to the differential export duty on palm kernels exported to foreign countries. Evidence on the subject was being taken by the Committee on West African Trade and Taxation, and a report was expected next month.—(Oct. 20.)

LEGAL INTELLIGENCE.

ALLEGED BREACH OF CONTRACT FOR SUPPLY OF POTASSIUM PERMANGANATE. *British Cyanides Co., Ltd. v. The King.*

In the King's Bench Division on October 13, 14, 15, Mr. Justice Darling heard a petition of right presented by the British Cyanides Co. against the Crown for alleged breach of contract in regard to supplies of potassium permanganate.

Suppliants' case was that in September, 1916, a verbal contract was entered into between Mr. W. J. U. Woolcock, an assistant director of army contracts, and Mr. Kenneth M. Chance, managing director of the Company, by which the Company was to supply permanganate to Government Departments at 3s. 6d. per lb.; and later on, when much larger supplies were required in the manufacture of saccharin, another contract was made to supply it to the saccharin manufacturers, Messrs. Boots Pure Drug Co., at 5s. per lb. Subsequently, Mr. Chance was asked to produce 15 tons of permanganate weekly, and the Company incurred heavy expenditure on special plant for a process which was admittedly uncommercial and therefore useless after the war.

By December, 1918, an output of 10 tons per week was attained, but in January, 1919, the demand for permanganate for Government saccharin ceased without notice having been given (large quantities of saccharin having been obtained from the United States) and the special plant erected by the suppliants became useless. They claimed a total of over £46,000 for breach of the agreement which the Departments had impliedly made.

The Crown denied that a contract had been made.

Dr. W. Vernon Shaw said that at the time in question he was acting for the Ministry of Food, which evolved the scheme for manufacturing saccharin in this country. After the suppliants had been asked to increase their supplies the Ministry placed contracts in America, because the amount produced here was insufficient. He remembered having told Mr. Chance on the telephone that so far as he knew the contract between the Ministry and the manufacturers of saccharin would terminate at the end of January, 1919. Mr. Chance denied that he had ever heard that the Ministry had cancelled the contract.

In his judgment, Mr. Justice Darling said that undoubtedly the suppliants were asked by Government officials to produce large quantities of permanganate, and in order to do so they had to use a particular chlorine process which was more costly than that hitherto employed. He was not satisfied that it was ever the intention of the Government to enter into a contract for the supply of permanganate at such prices, in such quantities, and for such a period as would reasonably remunerate suppliants for all their expenditure on plant, machinery, labour, and raw materials. He found, however, that there was an implied contract that the purchase of permanganate should continue for a longer period than it did continue, owing to what was done by the Government. There was an implied agreement that reasonable notice should be given of any change in the Government's policy which would interfere with the suppliants' business. The suppliants received no such notice until January, 1919, before which date they had proceeded with the manufacture of 50 tons of permanganate and laid in stocks of raw materials. He therefore made a declaration that the suppliants were entitled to damages for the breach by the Crown of an implied promise to give reasonable notice before terminating orders for the supply of permanganate of potash in the quantities and at the prices agreed to. All questions as to the length of notice and the amount of damages were to be decided by the referee to whom such questions were referred. He granted this declaration with costs against the Crown, and disallowed suppliants' claim for damages in respect of machinery and plant.

REPORTS.

REPORT OF THE FOOD INVESTIGATION BOARD FOR THE YEAR 1920. *Department of Scientific and Industrial Research. London: H.M. Stationery Office.* 1921. *Price* 1s. *net.*

The subject matter of the report is arranged in sections corresponding with the several committees of the Board, and a note is appended to each section showing the papers and reports which have been published during the year, or are about to be published. The Low Temperature Research Station is being erected on ground given by the University of Cambridge, and considerable progress has been made towards its completion; it will probably be ready for work by December, 1921.

A long report on the general theory of the preservation of food by cold has been prepared for the Board by Prof. W. Stiles. The Fish Preservation Committee has published an interim report on the brine-freezing of fish; an outbreak of the condition known as "pink eye" is under investigation. The work of the Meat Committee on the preservation of beef by cold has been discontinued pending the completion of the Research Station; the conditions determining the production of lactic acid in muscle have been investigated and two reports received, which will be published separately. Other investigations had reference to putrefaction, anærobic bacteria, mould fungi, etc.

The Engineering Committee has investigated the flow of heat through walls and the specific heat and conductivity of various insulators. In the flow of heat through an insulator two channels are available, namely, the solid itself and the air enclosed in the spaces of the solid; the heat flow through the former is negligible compared with the heat flow due to convection currents in the enclosed air. This result, unexpected because of the small dimensions of the spaces concerned, explains the want of agreement in the specific conductivity assigned by different observers to the same substance. The specific conductivity of a substance, *e.g.*, cork, depends much more on the form and size of the air-spaces (that is, on the "packing" of the material) than on the specific conductivity of the material considered as a continuous solid. The study of the mode of escape of heat from the surface of a wall has led to novel results. The chief source of loss is by convection currents set up in the air; these currents begin at the base and the flow at first is of a simple linear character. Over this region, which extends for about 2 ft. from the base, the rate of loss decreases as the height increases, owing to the ascending current of air becoming warmed. At a certain critical level, however, the linear flow breaks up into turbulent motion, and the rate of loss of heat increases and then becomes constant and independent of the height. Horizontal baffles, by destroying the turbulence and re-establishing linear flow, reduce the loss of heat. Use was made of the electrical resistance of a hot wire for measuring the velocity of air-currents; investigations on hygrometry have been continued and several new forms of hygrometers have been designed.

The work of the Fruit and Vegetables Committee dealt with the physiology of living fruit after it has been gathered, with the diseases of gathered fruit, and with the chemistry of the ripening process, including the chemistry of pectin and the destructive oxidation of the tissues which follows injury to certain fruits.

The Oils and Fats Committee has continued its study of the unsaturated fatty acids and the constitution of artificial fats derived from mannitol and methyl glucoside. A report concerning the effect of a diet containing putrefying meat on the health of animals has been completed. It is concluded that cases of poisoning from tinned meat are due neither to putrefactive bacilli nor to their products, but to the presence of some specific and highly toxic bacillus such as Gaertner's bacillus.

Final Report of the Departmental Committee on Spontaneous Combustion of Coal in Mines.

Mines Department. *Pp.* 114. *London: H.M. Stationery Office.* 1921. [*Cmd.* 1417.] *Price* 1*s.* 6*d.*

The committee appointed in 1912 to investigate spontaneous combustion in coalmines has now supplemented its interim report, issued in 1914 (Cmd. 7218), by a final report which deals exhaustively with the whole subject. The ground covered includes a historical review, a digest of the scientific evidence, a discussion of the conditions in the mine which are conducive to spontaneous combustion, a short section on hydraulic stowage (a consideration of which is strongly recommended to coalowners), and the conclusions and recommendations of the committee.

The main finding is that the spontaneous firing of coal in mines is not due to pyrites but to the direct oxidation of the coal substance. Pyrites assists the disintegration of the coal by rendering it more permeable, and the presence of moisture also promotes oxidation. Attention is directed to Dr. R. V. Wheeler's conclusion that the temperature of self-ignition is lower, the greater the oxygen content of the coal, and that a coal containing more than 10 per cent. of oxygen may be dangerous. The committee does not recommend any regulations supplementary to those recently brought into force, and based on the interim report.

In two appendices Dr. Wheeler describes experiments on the relative rates of oxidation of pyritic and non-pyritic coals, and a method of determining the relative ignition temperatures of different coals.

Report of the Committee of the Privy Council for Scientific and Industrial Research. 1920–21.

Pp. 121. *London: H.M. Stationery Office.* 1921. [*Cmd.* 1491.] *Price* 1*s.*

The report for the year ended July 31, 1921, contains a short report by the Committee of the Council which summarises the work of the year and deals very largely with financial considerations, and a much more detailed report by the Advisory Council, subdivided into (1) Industrial Research Associations, (2) National Research and Development of Research in and for the Empire, and (3) Aided Research, Patents, Publications of Learned Societies. There are eight appendices and a useful index.

The necessity for curtailing expenditure is causing the Council very great anxiety, for the reduction will involve not only the postponing of some important researches and delay in the progress of others, but will adversely affect the supply of competent workers. During 1920–21 the Department expended £552,219. The Fuel Research Station cost £40,889, the National Physical Laboratory £203,865 (receipts £45,770); £35,500 was given for the erection of the low-temperature research station at Cambridge and other work of the Food Investigation Board cost £27,032; grants to other bodies called for £20,912, and £40,850 was expended on research students (132), research workers (70), and assistants (43).

Six new research associations were established during the year, and the total number is now twenty-four. An association for Liquid Fuels for Oil-Engines and another for the Jute Industry will be incorporated shortly. The Rubber Research Association, which is acquiring new quarters at Croydon, is investigating the physical properties of crude rubber and the changes it undergoes in the preparatory processes of the works, and is also engaged in consultative work. The Refractories Association is taking over all the research work on refractory materials hitherto undertaken by the Institution of Gas Engineers; it is also co-operating with the Glass Research Association.

The question of associations undertaking for their members such work as usually falls to the professional analyst or engineer was discussed at a conference, where it was argued, on the one hand, that consulting work keeps an association *au courant* with the trend of research, and on the other, that the research work of an association should not as a rule be carried beyond the initial stage of practical application, and should keep in view the vital importance of fundamentals. The Department favours the latter view. Another question discussed at a conference was "the method of obtaining technical advice from expert members of a research association without giving them prior access to results."

Researches in hand at the National Physical Laboratory for boards and committees working under the Department include the investigation of radium luminous paint, the lubricating efficiency of various oils under different working conditions, gas cylinders, etc. The Fuel Research Board is co-operating with the Geological Survey Board in a survey of British coal seams; data concerning seams in Yorkshire, Notts, and Derbyshire have been collated and will be published soon.

Work for the fighting services is now largely carried on through the medium of co-ordinating research boards. The Chemistry Co-ordinating Research Board is investigating the possibility of producing formaldehyde in this country, different methods of attacking the problem being used at Holton Heath, Woolwich, and Oxford University. The Board was not successful in securing a supply of helium for research purposes, but a small quantity of pure radium bromide was obtained for researches required by the Government, and a fair amount of the impure salt is being worked up by the Government Chemist. A joint research on luminous paints is being undertaken with the Scientific Instrument Research Association and the National Physical Laboratory, and a special committee has been formed to co-operate with the Electrical and Allied Industries Research Association to examine the possibilities of further research on accumulators and dry cells.

The Adhesives Research Committee is investigating the production of glues and cements from animal sources and from uncommon vegetable sources. A process has been found for producing from the oil-free residues of castor beans and other oilseeds an adhesive which is applicable in the manufacture of plastic materials and distempers. The Oxygen Research Committee is investigating the substitution of non-inflammable substances for animal charcoal for use in the evacuated parts of metal containers. The Tin and Tungsten Research Board has been dissolved; it was found impossible to make the large-scale trials of the process for separating tin from its ores by volatilisation as chloride, but interesting results of work done on Prof. Truscott's proposed modification of slime treatment have been obtained and will be published shortly. Dr. A. Scott's work at the British Museum is bearing valuable results. He has improved the method of restoring drawings and pictures with hydrogen peroxide so that it is now generally applicable, even to water-colour paintings. A solvent has been found which will remove oil and varnish stains from documents without injuring the paper, and a method has been devised of arresting the discoloration of the metal base of enamels and of retaining the fragments of enamel in their proper places. Dr. Scott has also improved his processes for removing the deposits of copper compounds which form on antique silver objects. The standing committees on engineering, metallurgy, and mining have been disbanded.

The Committee recognises that many more applications for grants must be made in certain fields, *e.g.*, in chemistry, than in others, but would welcome more applications from workers in biology. On the important subject of scientific publications, the Committee adheres to its refusal to make grants-in-aid, and suggests that a direct grant from the Treasury would be the best solution, as that course would not only preserve the autonomy of the learned societies in the control of their publications, but the money obtained could be used for the whole field of scientific work and not merely for those branches which fall within the purview of the Department of Scientific and Industrial Research.

COMPANY NEWS.

NITRATE COMPANIES IN 1920.

The eight nitrate companies whose financial year does not synchronise with the calendar year achieved better results than in the corresponding periods of 1918—1919, but neither profits nor dividends came quite up to expectations. Most of these companies, however, greatly strengthened their financial position; their combined share capital was increased to £2,036,800, and outstanding debentures were reduced by £32,583 to £499,610; reserve funds were a little lower at £604,188, but the combined sums carried forward rose by £69,260 to £140,083. The dividends distributed amounted to £319,110, an average return of 12·5 per cent., as against £197,520 or 9·8 per cent. in 1918–19. Four companies disclosed an average estimated trading profit of 30·5d. per quintal against 29d. a year previously (Spanish quintal=101·44 lb.).

The output of the thirteen companies whose financial year terminates at the end of December is estimated at 9,354,432 quintals, against 4,460,395 q. in 1919. As a whole these companies did exceptionally well and only one reduced its dividend. The total issued capital remained at £3,864,950, and outstanding debentures were reduced by £89,600 to £258,800. Reserve funds (exclusive of sums used for depreciation, amortisation, etc.) increased by £159,244 to £1,209,016, and as reserves and carry-forward amounted to £2,393,098, or more than 50 per cent. of the total capital employed, the industry was placed in a very strong position. The sum of £828,496 was paid in dividends, which is equal to an average dividend of 21·4 per cent. on the total issued share capital, compared with 8·3 per cent. distributed on this amount in 1919. Combining the figures of the 21 companies, their total share capital was £5,901,750, upon which £1,147,606 was distributed in dividends, equal to 19·7 per cent., which compares with £521,705 on £5,885,750, or 14·9 per cent., in the preceding year. Statistical details of the individual performances of these companies are given at the foot of the page.

THE BRITISH CYANIDES Co., LTD.—The report presented at the recent annual meeting states that for the half-year ended October 31, 1920, there was a net profit of £20,046, but for the half-year ended April 30 last there was a net loss of £59,598, after deducting the balance brought forward. The loss incurred in writing down stocks was £77,774, and the net deficiency is being met by transferring £11,906 from the balance of repairs and renewals account and £50,000 from the reserve, reducing that account to £50,000. After paying 5 per cent., free of tax, on the preference shares, there is a balance of £958 to be carried forward. Owing to trade depression and accumulation of stocks the Tat Bank factory was closed early in 1921, and the Pope's Lane factory in May on account of the coal strike. There was some improvement in demand during July and manufacture was partly resumed in August. The company's holding in the British Potash Co. (capital £100,000) was increased during the financial year from 25,960 to 95,000 £1 shares, valued at £43,696, the new shares being acquired against shares in the parent company, whose capital was raised for the purpose. The Potash Co., which owes the Cyanides Co. £31,078, has also suffered severely in the trade depression, and it will not be able to resume operations until the blast furnaces throughout the country get to work again. The new furnace designed by Sir Arthur Duckham for the fixation of atmospheric nitrogen by the barium process has been completed and is being started up.

Companies.		Production. Quintals.	Inc. or dec.	Trading profits.	Inc. or dec.	Net profits.	Dividends.	Inc. or dec.
			%	£	%	£	%	%
Lagunas Synd.	1919–20	—	—	38,061	− 8·1	20,911	nil	—
Liverpool	„	—	—	247,985	+ 50	126,997	140	—
London	„	—	—	64,969	+ 47·8	28,182	7½	+ 2½
Pan de Azucar	„	374,000	+ 94·7	23,129	+ 1·6	6,545	10	—
Santa Catalina	„	318,756	+ 136·3	28,896	+ 28·8	25,086	20	—
Santiago	„	—	—	20,597	− 64	14,459	7½	—
New Tamarugal	„	990,000	+ 336·1	138,501	+ 475·9	111,482	20	+20
Rosario	„	1,033,249	+ 52·6	212,200	+ 158·3	125,665	20	+10
Aguas Blancas	1920	764,000*	+ 308·5	68,213	+ 590·2	58,150	100	+100
Alianza	„	2,019,161	+ 146	875,206	+1010·6	780,692	75	+65
Angela	„	156,386	− 34·7	41,631	+ 456·2	21,003	20	+10
Anglo-Chilean	„	1,745,000	+ 12·2	567,748	+ 250·4	457,152	26	+10
Barrenechea	„	252,000*	+ 581·1	37,665	+ 63·7	33,090	50	+35
Lagunas Nitrate	„	477,000*	+ 783·3	67,192	+ 153·9	47,177	4	+ 2
Lautaro	„	1,309,000*	+ 87·1	4,954	− 95·1	6,334	nil	−16
New Paccha	„	249,000*	+ 322	7,825	+ 149·9	4,676	8	+ 3
Salar del Carmen	„	259,910	+ 25·4	84,461	+ 229·1	45,936	16	+10
San Patricio	„	—	—	10,443	+ 160	9,074	6	+ 6
Santa Rita	„	410,000*	+ 811·1	42,294	+ 415	37,891	25	+20
San Sebastian	„	169,715	+2728·6	45,850	+ 259·8	37,016	nil	—
Tarapaca	„	643,260	+ 501·1	89,224	+4808·4	69,234	10	+10

* Estimated.

—(*S. Amer. J.*, *Mar.* 19, *Sept.* 10, 1921.)

OFFICIAL TRADE INTELLIGENCE.

(*From the Board of Trade Journal for October 13 and 20.*)

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W. 1, from firms, agents or individuals who desire to represent U.K. manufacturers or exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department and quoting the specific reference number.

Locality of firm or agent.	Materials.	Reference number.
Australia	Brass, copper, aluminium	312
British West Indies	Glassware	316
Canada	Iron perchloride, zinc oxide, special alums, heavy chemicals, dry colours, dyes, gums, waxes, shellac	314
South Africa	Crockery	347
Belgium	Asphalt, graphite, asbestos, cement, plaster of Paris	318
"	Corundum, emery, glass and sand papers	319
France	Copper sulphate	323
Germany	Copra, crude and edible oils	324
Spain & Portugal	Tinplate	329
Switzerland	Cod-liver oil	352
"	Glassware, china, earthenware	353
United States	Wire rope, china	330
"	Optical goods	334
"	Chemicals, pharmaceutical specialities	358
"	Yellow metal, sheathing	360
Argentina	Disinfectants, lubricants, pitch, asphalt, cement (tender for)	4773/ F.L./P.N.
Panama	Cement, paint, varnish, oil, turpentine	340
Tunis	Chemicals, pharmaceutical products	354

MARKET SOUGHT.—A firm in Valparaiso wishes to get into touch with U.K. importers of beeswax, hempseed, and ox hides. [337.]

TARIFF. CUSTOMS. EXCISE.

Antigua.—The revised customs tariff, which differs but slightly from the former tariff, may be inspected at the Department.

Australia.—As from August 3 the import of wine essences, whether natural or artificial, is prohibited.

The actual amount of excise duty drawback obtained in the country of origin will be allowed as a deduction from the fair market value of perfumes imported into Australia.

Germany.—Certain wares of asbestos no longer require an entry permit on importation into the Unoccupied Territory from the Occupied Territory.

An Order has been issued increasing from 900 to 1,900 per cent. the premium leviable when the "gold" duties of the customs tariff are paid in paper currency.

Germany (Occupied Territory).—Lists of goods which do not require import and export licences may be seen at the Department.

Honduras.—The export duty on hides has been withdrawn as from August 30.

Italy.—Increased stamp taxes are payable on perfumery and beverages.

Oilseeds used for the production of industrial oils are now admitted duty-free.

Latvia.—A copy of the new export duty tariff which came into force on October 15 may be seen at the Department.

Mexico.—The import duty on untanned skins has been reduced to 4 centavos per kg.

Nyasaland.—The revised customs duties came into force on October 1.

St. Christopher-Nevis.—A copy of the revised customs tariff may be seen at the Department.

South Africa.—As from January 1, 1922, only registered stock dips may be sold. The form of application for registration requires the names and percentages of every effective ingredient to be stated.

Sweden.—Export prohibitions have been removed from raw phosphates, sugar, glucose, syrup, colouring matter, Chile saltpetre, Stassfurt salts (not specially mentioned), Thomas phosphate, calcium nitrate, cyanamide (?), bone meal, and guano.

Switzerland.—Import licence is not required for fibrous materials for the manufacture of paper when imported over the Franco-Swiss and Italo-Swiss frontiers.

Tanganyika Territory.—Modifications have been made in the import duties payable on alcoholic beverages, perfumes, sugar, chemicals, kerosene, petrol, paint, turpentine, and soap.

Revised export duties are payable on ivory, gum copal, rubber (other than plantation), hides and skins.

Tunis.—The "coefficients of increase" on various chemical products are identical with those contained in the French decree of August 21.

Yugoslavia.—Export duties are payable on, *inter alia*, opium, hides, skins, scrap-iron, old copper, and copper alloys. The revised list of export duties may be seen at the Department.

Zanzibar.—The *ad valorem* rate of duty has been increased to 10 per cent. as from August 10.

TRADE NOTES.

BRITISH.

Market for Barytes in the United States.—H.M. Vice-Consul at Philadelphia reports that there is a good demand in the United States for ground barytes of the finer grades, especially for guaranteed white, fine-ground, and floated, at $22 per ton f.o.r., or ex-dock New York or Philadelphia. The British product has not been offered for sale in the United States for some time, but recent importations from Europe, not being sufficiently white, have not commanded the best prices. Importers may be reluctant to do business owing to the impending revision of the customs tariff, by which almost prohibitive duties will be placed on barytes, but it is reported that the Tariff Bill may be considerably amended before it is passed, probably in March, 1922. British firms may obtain the names of importers and users at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen St., London, S.W. 1.

The Nitrate Market.—The *Financial Times* announces that the Chilean Nitrate Producers' Association has made an agreement with the Nitrate Pool whereby, in consideration of the latter releasing the Association from its undertaking not to sell nitrate below 14s. per quintal f.o.b. Chile, the Association will pay the Pool and other buyers a minimum indemnity of £1,500,000, which will be collected and paid by contributions ranging from 1s. 8d. to 4d. per quintal for definite periods from October 1, 1921, to June, 1923. The Association will fix the following scale of prices to operate up to June 30, 1922, viz., October, 10s. 6d. per quintal; Nov., 1921—April, 1922, 11s.; May, 1922, 10s. 9d.; June, 1922, 10s. 3d. per quintal.

Grenada in 1920.—The export of cacao, 6162 t., was one of the largest, and that of cotton, valued at £48,679, the largest on record. The successful cultivation of limes proved to be but temporary, exportation falling from 178,525 galls. in 1919 to 23,310 galls. in 1920. Total imports and exports increased in value to £620,378 and £616,499, respectively, the latter increase being due entirely to higher prices. Of the imports the United States supplied 34·3 per cent., against 31·3 per cent. in 1913; tho share of the United Kingdom has declined during that period from nearly 40 to 31 per cent. Despite the preferential tariff of 33⅓ per cent. on goods of Empire manufacture, the United States can still compete successfully with the United Kingdom, and American medicines, drugs, perfumery and soap are displacing goods from the United Kingdom.—(*Col. Rep.-Ann., No.* 1078, 1921.)

Uganda in 1919-20.—Cotton is now grown on 163,850 acres, and its cultivation is increasing. The output of cotton in 1919-20 rose by 75 per cent. to a value of £1,828,537, and the export, 6523 t. worth £1,209,663, represented 66 per cent. of the entire export trade. Coffee ranks second in importance to cotton, and 2948 t. worth £161,714 was exported. Cultivation of Para rubber is extending and valuable results have been obtained from tapping experiments; the output was 224 t. from nearly 20,000 acres. Little progress was made in the cultivation of cacao, but sugar-cane offers promise, although restricted by the lack of a market. There is ample scope for the extensive production of oilseeds, especially groundnuts and sim-sim, and flax seems likely to become an important crop; the export of sim-sim was 1169 t. With further facilities for exploitation and development, the forests of Uganda should become a source of considerable revenue (*cf.* J., 299 R).—(*Col. Rep.-Ann., No.* 1079, 1921.)

FOREIGN.

The Chemical Market in Venezuela.—There is a fairly important demand for medicinal preparations in Venezuela, the annual imports being worth several hundred thousand dollars. About 50 per cent. of the imports is supplied by the United States and 20 per cent. by France. Imports of disinfectants were valued at over $100,000 in 1919, but there is little scope for new disinfectants or medicinal preparations without a long advertising campaign. The extent of the market is shown by the following statistics of imports in 1919:—Carbon dioxide, compressed, $22,000; caustic soda, $95,000; carbide, $68,000; paints and colours, 300 metric tons; iron rods and bars, 1000 t. Most of the cement has been supplied by the United States, but of late cheaper German and Swedish cement has been coming on the market. Cheap glassware, particularly bottles, is turned out in several factories in Venezuela, but tumblers are imported in quantity, mainly from Belgium and Germany.—(*Bull. Dept. Trade and Com., Canada, Aug.* 22, 1921.)

Trade of Bulgaria in 1920.—During 1920 exports from Bulgaria increased considerably in quantity, and imports rose by 50 per cent. Comparison between values is impossible owing to the fluctuating value of the currency. The total exports amounted to 185,381 metric tons, valued at 1,642,998 leva (lev=9½d. at par, now 0·44d.), the items including alcohol 30 metric tons, dried intestines, etc. 32 t., charcoal 11,650 t., opium 2·5 t., and otto of roses 4 t. By value, Italy took 17 per cent. of the exports, Czecko-Slovakia 12, Germany 10, and Austria 9 per cent. Imports into Bulgaria in 1920 exceeded those of 1919 by more than 50 per cent. in quantity; among them were (126,152 t., worth 2,213,830 leva) fertilisers 20 t., chemicals 2654 t., tanning and dyeing materials, paints and varnishes, 2424 t., tar, mineral oils, etc., 11,816 t., oils, fats, waxes 5798 t., drugs and medicines 69 t., perfumery 7 t., stones, earths, glass and manufactures thereof, 3638 t. Italy supplied 28 per cent. of the imports (largely textiles), followed by Turkey with 18 and Great Britain with 14 per cent. respectively. The total imports were 126,152 t., worth 2,213,830 leva.—(*U.S. Com. Rep., July* 23, 1921.)

REVIEWS.

The Riddle of the Rhine: Chemical Strategy in Peace and War. *By* Major V. Lefebure, *with an introduction by* Field-Marshal Sir H. Wilson. *Pp.* 277. (*London: W. Collins, Sons and Co., Ltd.* 1921.) *Price* 10*s.* 6*d. net.*

It may be held that the application of science to the promotion of chemical warfare is an atrocious practice unworthy of the chemist; but the methods of warfare that were practised before the use of chemical poisons are likewise degrading, and it is an open question whether the actual means of causing death or mutilation (except from the military point of view) is one of great consequence. The vital importance of the organic chemical industry to the nation during the war was realised above all by the chemist, who may even be said to have believed that if the organic industry of the Allies had been as powerful as that of Germany, the war would either never have been, or would have been only of very short duration. The question whether it is better to be in a state of semi-preparedness or to depend upon Treaties as a safeguard against future war, though of considerable interest, is one which lies beyond the sphere of the chemist. But it is strictly his domain and responsibility to point out to the leaders of State that the disarmament of Germany upon the lines of 1914 warfare—musketry, guns, ammunition, men—shows a want of appreciation of the functions of chemical industry in warfare, and places those nations undeveloped in this respect in a Fool's Paradise. The potentiality of the organic chemical industry of any nation and the number of trained chemists at its bidding are the outstanding factors which determine the possibility of making or preventing war in the future.

This subject has been admirably treated by Major Lefebure in the book under notice. Although many of us as chemists have been connected in some way with the manufacture of poison gas or of material used as means of defence against its action, few have acquired the comprehensive outlook gained by Major Lefebure owing to the unique facilities placed at his disposal during the war. The development of chemical warfare as practised by the Germans and later in retaliation by the Allies is described in detail. With the introduction of each new chemical weapon came the necessity for securing protection to the operator, whilst the attacked forces were driven to adjust their means of defence to suit the new conditions. The search for a form of chemical warfare, which either by its novelty or its method of application would constitute a surprise attack, thus became very important, for when found it involved not only an elaborate re-arrangement of defensive methods, but also a general lowering of the morale of the troops attacked until adequate measures of protection had been devised. Before they used mustard gas the Germans had employed irritants which affected the respiratory system or the eyes. Mustard gas, in addition to possessing these properties, also affects the body and penetrates thick clothing, even boots, so that it was often only identified hours after the damage was done. While one set of poisons made necessary a certain type of mask, further developments aimed at employing irritants in such a form that would render ineffective the existing pattern of mask—of which perhaps millions were in use. The picture of the belligerent nations fighting for chemical supremacy is drawn vividly by the author, whose book contains such excellent material that it must be read and, indeed, studied. It will then be realised that the war in its later stages had developed into a struggle between the chemical industries of the combating countries; a struggle to gain the chemical initiative and to present fresh problems of surprise.

During the war the British Government and people were brought to realise the necessity for establishing a great chemical industry by the unfortunate shortage of dyes, and later of high explosives. We as chemists are not concerned with making war, but any literary contribution that excites public interest in the development of our organic chemical industry is of the utmost value to us. Whilst we appreciate on the one hand the need of the chemical industry as a safeguard against war, we know also that the future commercial prosperity of the country is bound up with its development. As a means of furthering the interests of the British chemical industry this book will play an important part.

Although the author has demonstrated that chemical disarmament is the most vital factor in securing world peace, and has shown that this has been neglected in the Peace Treaty, yet the limitation of chemical armament could only be attained by curtailing the organic chemical industries of the world, and this would materially affect commercial prosperity. There is but one solution to the "Riddle of the Rhine," and that is to safeguard our nation by the creation of a great organic chemical industry.

E. V. Evans.

A Dictionary of Applied Chemistry, Vol. II. *Calculi—Explosion. By* Sir Edward Thorpe. *Revised and enlarged edition. Pp. viii.+717. (London: Longmans, Green and Co.* 1921.) *Price* 60*s. net.*

Thorpe's Dictionary is such a standard work of reference in technical laboratories that the successive volumes of the new edition are awaited with interest by many chemists. The second volume, which has recently appeared, covers the ground from Calculi to Explosion of Gases. Many of the articles have been extended, and in some cases new articles have been added, but some judicious pruning has also been applied, so that the space occupied has not been unduly increased.

In accordance with the increasing interest which has attached to subjects such as the application of catalysis to industrial chemistry, the corrosion of metals and its prevention, decolorising carbons, and the influence of constitution on colour, new sections have been added to the articles bearing on these, and in some cases new articles have been included. In other cases, more modern examples have been chosen to illustrate the applications of chemical principles, as for instance the Haber process for the synthesis of ammonia. The article on colloids has been somewhat extended, but in view of the outstanding importance of this subject a fuller treatment might have been accorded to it.

Most of the important articles show signs of revision. Thus the section on carbohydrates has been considerably amplified to include the newer work bearing on constitution; that on cellulose has been extended, and the article on alkaloids has been revised in accordance with the more recent developments. Coke and By-products includes the recent work on the extraction of ethylene for the manufacture of alcohol. As an instance of a purely new war-product, the chemistry of dichlorodiethyl sulphide is included among the ethyl-compounds. The section on Gaseous Explosions has been very thoroughly revised and will be found very helpful in connexion with the increasing importance of internal-combustion engines.

A point which is open to some criticism is the difficulty of turning rapidly to a required compound in many cases. It must be admitted that chemical nomenclature does not lend itself readily to alphabetical treatment. Closely allied compounds are often widely separated when classified alphabetically. This has led to a treatment which is partly systematic, as in the group of compounds under "Ethyl," and partly alphabetical—ethylaniline and diethylaniline, for instance, are placed under their respective initial letters. Cross references lead to a certain amount of impatience and even profanity, especially when they necessitate turning to a different volume, and still more when they refer to a volume which has not yet been published.

A further criticism is that in many cases insufficient reference is made to the applications of chemical compounds. Thus no indication is given of the uses of the ethylanilines, and similarly in a large number of other instances. The importance of this point in a work on applied chemistry needs no stressing, and it is hoped that it will receive attention in the later volumes. In this connexion it may be noted that many compounds are included that have little or no technical interest, as for instance a number of organic selenium compounds, ethylidene derivatives, and so on. The proper place for these is in a work on pure organic chemistry, and space might well have been saved by their omission.

R. C. Farmer.

PUBLICATIONS RECEIVED.

The Popular Chemical Dictionary. *By* C. T. Kingzett. *Second edition. Pp.* 539. *(London: Baillière, Tindall and Cox.* 1921.) *Price* 21*s.*

Confectioners' Raw Materials. *By* J. Grant. *Pp.* 173. *(London: Edward Arnold and Co.* 1921.) *Price* 8*s.* 6*d.*

Organic Analysis: Qualitative and Quantitative. *By* E. de B. Barnett *and* P. C. L. Thorne. *Pp.* 168. *(London: University of London Press, Ltd.* 1921.) *Price* 7*s.* 6*d.*

I Problemi dell' Azoto: Tentativi Industriali della Fabricazione del Nitruro di Alluminio. *By* C. Toniolo. *Pp.* 20. *From the Giornale di Chimica Industriale ed Applicata, July-August,* 1921. *Milan.*

Bulletins of Indian Industries and Labour. (*Calcutta: Superintendent Government Printing.* 1921):—
- No. 12. Notes on Bauxite, Borax, Corundum, and Garnet. *By* J. Coggin Brown. *Pp.* 54. *Price* 10 *annas.*
- No. 15. Notes on Mica. *By* J. Coggin Brown. *Pp.* 45. *Price* 9 *annas.*

Publications of the United States Geological Survey. *Department of the Interior. (Washington: Government Printing Office.* 1921.):—
- Phosphate Rock in 1920. *By* R. W. Stone.
- Feldspar in 1919. *By* L. M. Beach.
- Salt, Bromine, and Calcium Chloride in 1920. *By* R. W. Stone.
- Gypsum in 1920. *By* R. W. Stone.
- Peat in 1920. *By* K. W. Cottrell.
- Copper in 1919. *By* H. A. C. Jenison.
- Platinum and Allied Metals in 1920. *By* J. M. Hill.
- Cement in 1919. *By* E. F. Burchard.
- Graphite in 1920. *By* L. M. Beach.
- Strontium in 1920. *By* G. W. Stose.
- Fuel Briquettes in 1920. *By* W. F. McKenney.
- Fluorspar and Cryolite in 1920. *By* H. W. Davis.
- Arsenic, Bismuth, Selenium, and Tellurium in 1920. *By* V. C. Heikes.

THE UTILISATION OF WOOD WASTE.*

ALEX. RULE.

The problem of utilising to the best advantage the vast amounts of waste which result from felling operations in the forest as well as from the conversion of logs into timber at the saw mills, is one which concerns the Forest Authorities not only of Australia but of other parts of the Empire in which forests form a natural source of wealth. In all civilised and rapidly developing countries it is now generally recognised that the simple process of felling a tree to meet every small requirement in the way of timber or fuel cannot be carried on for ever. Conservation of forest resources is gradually becoming stricter, felling is carried out according to definite working plans, and efforts are constantly being made to introduce less wasteful methods of operation. It is natural therefore to find that increased attention is also being drawn to the possibilities of utilising in various ways the residual material, slabs, sawdust, etc., which are commonly designated "wood waste."

The publication by the Australian Institute of Science and Industry of Bulletin 19, devoted entirely to a lengthy report from Mr. J. H. Boas, the officer in charge of Forest Products Investigations, indicates that the Australian Government has recognised the importance of this subject at a comparatively early stage in the exploitation of the country's forests. Mr. Boas has summarised very systematically the various methods which have been introduced, or suggested, in other countries for dealing with wood waste of all descriptions. As may be gathered from the statistics given in the report, enormous quantities of this material are available in different forms. To cite one example, the author estimates that in Australia the total mill waste alone amounts to no less than 1,500,000 tons per annum.

In compiling the report the author has naturally drawn on the reports from the Forest Products Laboratories of other countries, especially of America and Canada. The use of the waste as fuel in various forms, in the manufacture of small articles, for conversion into wood pulp and the various applications of that substance, as well as the organisation of a wood-waste exchange, are all considered; but the author is of the opinion that wood distillation offers one of the best prospects of dealing with the problem, and a large section of the report is devoted to a description of that industry as carried out in other parts of the world.

A certain amount of research work has already been done in this connexion on Australian timbers and the results taken from the New South Wales Reports of the Forestry Commission for 1918–19 are reproduced in the Bulletin. Unfortunately, owing to lack of data, it is scarcely possible to compare the yields given with those obtainable from European and American hardwoods, but it would appear that considerably lower yields, at any rate in respect of acetic acid and methyl alcohol, are to be expected from the majority of the Australian woods as a result of distillation.

Of particular interest in regard to the prospect of founding the industry on a commercial basis in Australia are the figures showing the imports of various wood-distillation products into the country for 1914–15. From these figures it would appear that the carbonisation of about 1000 tons per week of waste wood in Australia would cover the whole of the charcoal, wood naphtha, and acetic acid at present supplied from outside sources, although, as the author points out, the development of industries in Australia is likely to lead to an increase in the demand for such products. It is probable therefore that the author is correct in stating that "the prospects are sufficiently good to warrant the establishment of at least some small plants in favourable situations to demonstrate the possibilities," but in view of experiences elsewhere, and taking into account the present outlook for the industry, the question as to how far wood distillation can be extended with a view to solving the problem of utilising wood waste under conditions such as are found in Australia is one which will require very careful examination.

Wood distillation is not as a rule a main-product industry in the sense that the demand and price obtainable for one of the products are sufficiently great to make the distiller indifferent to the disposal of the remaining products. There are undoubtedly cases where a local demand for one product may be sufficiently good to ensure its steady sale, but it is always a question of how far the selling price of that product will compensate for any lack of demand and consequent low selling value which may occur in the case of the other products.

The demand for acetic acid is only likely to increase rapidly if further uses are found for it, and in that event the wood distiller will have to meet competition from the synthetic processes which are now well established and were working successfully during the war. Given a reasonable market for the other products of distillation, this competition can no doubt be met, but these products will only bear the burden of competitive selling of acetic acid up to a point.

Mr. Boas is of the opinion that if ethyl alcohol comes into common use for power purposes large quantities of methyl alcohol will be needed for denaturation. This is a matter of the highest importance to the future of the industry, but it is difficult to see at present how it is going to be profitable to the wood distiller to increase his producing capacity for the purpose of turning out more methyl alcohol, which must be sold at a reasonable price, unless markets are found for the other products, namely acetic acid and charcoal, which must be produced at the same time. The distiller would always have to face the possibility of the introduction of cheaper denaturants, as well as the likelihood of a synthetic process for the production of methyl alcohol being developed and established on a commercial basis as a result of the impulse given by a greater demand for the product.

During the war the process of wood distillation received a boom which was purely relative to the abnormal demands for its products, and it is evident, in view of the interest it has since aroused in practically every country in the world, that it is still regarded as a means of solving to a very large extent the problem of utilising not only wood waste, but waste of vegetable origin from all manner of processes and industries. That there is still room for the development of the industry in certain localities is an undoubted fact, but it cannot be too strongly emphasised that unless such schemes are examined very closely in the first place, not merely on the technical side, but more especially in regard to their commercial possibilities in local or foreign markets, and in the latter connexion not only in relation to the disposal of one product, but of all the products, they are likely to end in disaster.

In addition to wood distillation, the author deals at considerable length with the possible uses of sawdust, especially as the raw material for the manufacture of industrial alcohol, paper, etc. As a result of his investigations he arrives at the very sound conclusion that there is probably no one method of dealing with wood waste that would be satisfactory in all localities or big enough to handle all the available material. He recommends the development of several industries and preferably a series of associated manufactures, some of which might use the waste products of others.

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*WOOD WASTE. By J. H. BOAS. Commonwealth of Australia Institute of Science and Industry Bulletin No. 19. Published under the Authority of the Executive Committee of the Advisory Council. (Melbourne: A. J. Mullett, Government Printer, 1921.)

It is obvious that the author is aware of the necessity for caution when he emphasises the importance in the first place of research on the suitableness of the material for various purposes, and, secondly, of a study of economic conditions upon which the business possibilities of the industries would depend.

This report is a most useful publication. It is written with a sense of proportion which since the war has unfortunately been lacking in many quarters, and its perusal may be heartily recommended to Forest Authorities in general who are faced with the problem of the disposal of wood waste and may be attracted towards the establishment of some industry such as wood distillation in the hope that it alone will provide a simple solution of the difficulty.

The author will no doubt have noted a few obvious but minor errors in the text for rectification in any further edition of the Bulletin which may appear.

RECENT LEGISLATION IN GREAT BRITAIN FOR THE PROTECTION OF ITS DYE INDUSTRY.*

The first attempt to protect the dye industry in Great Britain was by means of a Proclamation made in February, 1919, whereby the importation of dyes was prohibited except under licence. This action was prompted by a realisation on the part of the Government that Germany would attempt to regain her world supremacy in the supply of dyestuffs. Thus in 1918, and before the armistice, the then President of the Board of Trade (Sir Albert Stanley) stated in Parliament:—"The importation of all foreign dyestuffs shall be controlled by a system of licences for not less than ten years after the war, in order to safeguard this industry against the great efforts which the great German firms are certain to make after the war to destroy all we have accomplished during the war and to make this industry again subservient to Germany."

It was most unfortunate that the first system of licensing was shortlived. A test case brought before the Law Court, in December, 1919, resulted in a judgment which ruled this procedure to be illegal. Licence to import became unnecessary, and whereas in the first few months following this judgment only small quantities of dyewares were imported, these products were literally rushed into the country during August, September, and October of last year. This unrestricted importation continued until the passing of the Dyestuffs Act in January of this year, but by that time large stocks had been acquired by the merchants, who cannot altogether be blamed for having taken advantage of the peculiar rate of exchange existing between England and Germany, which operated entirely in their favour.

Now the effect of this was to flood the British market with dyewares and cause a marked check to the development of the dye industry. This excessive importation, which was a practical demonstration of the forecast made by Sir Albert Stanley, again impressed upon the Government the need of protective legislation, and eventually the Dyestuffs Act was passed.

The difficulty in launching the Act lay in the fact that the great British textile industry, which was worth to the country one hundred times as much as the value of the dyewares required for its maintenance, was, in pre-war days, adequately supplied from Germany, and it was obvious that it would require great statesmanship to devise the means to be taken to protect the dye industry without in any way prejudicing the textile trade.

It is only natural that the dye-consumers were greatly concerned about the difficulties which might arise in the conduct of their business if the restrictions on imported dyewares became too drastic, and much negotiation took place between the Government and representatives of the dye-users before a Bill could be drafted which would both meet the needs of the growing dye industry and protect the interests of the textile industry. In the writer's opinion the Bill which eventually became an Act ably met these conditions.

The Dyestuffs Act of 1920 prohibits the importation, except under licence, of all synthetic organic dyestuffs, colours and colouring matters, and all organic intermediates used in their manufacture; it became operative on January 15 of this year, and is intended to remain in force for a period of ten years from that date.

Licence to import is granted by the Board of Trade, and a committee, called the Licensing Committee, advises the Board in respect of such licences. The constitution of this committee is, obviously, of considerable importance; a clause in the Act states that it shall consist of five persons representing dye-consumers, three persons representing the manufacturers, and three other persons not directly concerned as either user or manufacturer, the chairman of the committee to be one of the persons coming under the last category. It is thus seen that the interests of the users are safeguarded by a greater representation being accorded to them than to the manufacturers. The position of chairman is at present occupied by Sir Harry Kilvert.

Another clause of the Act states that there shall be constituted a further committee to advise the Board with respect to the efficient and economical development of the dye-making industry, and this committee, which is now in being, is called the Development Committee.

The method of procedure adopted by the Licensing Committee is as follows. The Committee meets each fortnight to consider the applications for licences received by the Board of Trade. Prior to this meeting the applications are carefully examined by two technical advisers representing, respectively, the interests of the users and manufacturers. These experts are able, by consulting their principals and by their own experience, to determine whether there exists a British equivalent or adequate substitute for each dyeware for which application has been made: if there be such, the licence is refused by the Committee and the applicant is referred to the British manufacturer producing the required dyeware.

The Committee has now been sitting for nine months and, with the aid of the valuable information which has been accumulated, it has been found possible to divide into three classes the dyewares for which licences are applied:—

I. Dyewares for which it is agreed by both user and maker that equivalents or adequate substitutes are to be obtained in Britain.

II. Dyewares for which there is no British substitute.

III. Dyewares of which the properties or characteristics are unknown and which require further examination.

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*From a paper read by E. V. Evans before the *Société de Chimie Industrielle*, Paris, October, 1921.

Licences are naturally refused to dyewares falling under Class I, and granted to those of Class II. In many cases the dyestuffs of Class III are mixtures, and in others they are dyewares applied for under a name unknown to British manufacturers. These have to be specially tested before a decision can be made, and as a result of this test they are allocated to either Class I or II, and dealt with accordingly.

In general principle it is laid down that the decision of the technical advisers on the question of a British colour being equivalent to one of foreign origin shall constitute only *primâ facie* evidence, and that if a doubt be cast by the user upon the decision, the onus of proof falls upon the manufacturer, who must demonstrate to the user that his colour is an adequate substitute. On the other hand the question of price, which might be important owing to the abnormal rate of exchange between England and Germany, is only considered by the Committee if the consumer proves that his business is materially affected by accepting British dyewares at ruling prices. The present writer, who represents on the committee the manufacturers of intermediates, welcomes the opportunity of testifying to the good collaboration that exists between the representatives of the users and manufacturers on the Committee in carrying out the principles of the Act.

Now the main value of the Licensing Committee to the dye industry is to protect its interests in its present state of development, but from the chemists' point of view a far greater service can be rendered by the Development Committee. It was obvious to the Government that the object of the Act could not be attained simply by creating machinery to control imports, and so to the Development Committee was allocated the far more important and difficult task of advising with regard to the promotion on a sound basis of an efficient and comprehensive dye industry. This committee consists mainly of dye-manufacturers and prominent chemists, and is in reality a board of technical experts appointed to consider the many problems which arise from the granting of import licences with a view to extending the industry in the required directions. The chairman of the committee is Mr. W. J. U. Woolcock, M.P., who played such a prominent part in the Parliamentary consideration of the Dyestuffs Bill.

The above is a brief outline of the means adopted by Great Britain to protect its dye industry. It may be said that the scheme has not yet been fully tested, for it is working at a time when there is not only a severe slump in trade, but when there still exists a large stock of dyewares brought into the country in 1920. The first months of working the Act have, however, shown that both the users and manufacturers are determined, with the machinery placed at their disposal by the Government, to do their utmost to promote the development of the dye industry in Great Britain. The operation of the Act has already resulted in greater collaboration between user and consumer, and with the increased knowledge that is being gained of the requirements of the consuming interests, the manufacturers are enabled to extend and modify their activities to meet the needs of the country.

If it be asked to what extent the British dye-manufacturers will be able to supply the country's requirements, the answer is as follows. Prior to the war the manufacture of dyes in Britain amounted to about 2000 tons and imports were about 20,000 tons. In 1918, 17,500 tons was manufactured in England and 2000 tons was imported; in 1919, 20,000 tons was manufactured in the country, and 2500 tons was imported. These figures demonstrate the rapid progress made by the industry within recent years, and although the range of colours at present manufactured is not as extensive as is required, this achievement will undoubtedly follow in due course. These early endeavours certainly warrant some form of protection by the Government at a time when German competition is particularly severe owing to the reduced value of the mark, as well as to the fact that German manufactures are produced in plant, of which the capital value is so materially written down. It is unreasonable to imagine that the position attained by Germany after 30—40 years of strenuous endeavour can be reached by a young industry within a few years. The British dye industry, although young, is vigorously exerting itself, and there is every hope that the manufacturers will succeed in their resolve to establish it upon a firm and lasting foundation.

STANDARDISATION OF PLANT: FILTER-PRESS PLATES.

Report of a Joint Committee of the Association of British Chemical Manufacturers and the British Chemical Plant Manufacturers' Association on the Standardisation of Filter-press Plates.

As a result of the *questionnaire* which was sent to all members of the Association of British Chemical Manufacturers and to a number of others known to be large users of filter presses, details of over 800 cast-iron presses have been collected. The range of sizes was very large and varied, but the majority fell into one of four very definite groups, namely 18½ in., 25 in., 32 in., and 38 in. square; these were, therefore, adopted, and include 67 per cent. of the total number of presses reported upon.

It was decided that the following details should be standardised:—Size of plate and cake (measured on outer and inner edges of joint surface); diameter and centres of side-bars; sizes and position of wash- and feed-passages; size and nature of attachment of feed-cocks, wash-cocks, filtrate-taps, and height of press (clear height between floor and bottom of plates).

The following are to be left to the discretion of individual manufacturers, namely:—Type and details of closing gear, fast and loose heads and standards, supports for side-bars; character of filter-surface and style of handles of plates or frames.

For the present it is proposed not to go beyond the following types in common use:—

(*a*) Recessed plates, centre-feed, non-washing.

(*b*) Plate and frame, top-feed, washing pattern, internal lugs.

(*c*) Plate and frame, side-feed, washing pattern, external lugs.

After careful consideration the Committee is convinced that a distinct economy with increased efficiency in washing is to be obtained in many cases by the provision of a rib or flange about ½ in. deep round the interior of the frames of washing presses on the wash-water outlet side, and it is proposed that this be a standard arrangement. It is further proposed that all filtrate- and air-cocks should have "cleaning-type" nozzles, and that facings should be the same for both. All cocks over 3 in. are to be of the flanged type, and those under this size are to be screwed, but may be fitted with loose flanges if desired. All flanges are to be drilled to British standard table No. 2.

The accompanying plan, L.H. 3184, and table give the principal dimensions recommended, but detail drawings of all types and sizes proposed are available and will be sent on application.

The above proposals of the Committee, together with drawing L.H. 3184 and the following *questionnaire* have been circulated to all the firms previously approached who showed any interest in the matter:—

QUESTIONNAIRE.

Proposed Standards for Cast-iron Presses.

(1) Do you agree with the types proposed for standardisation?

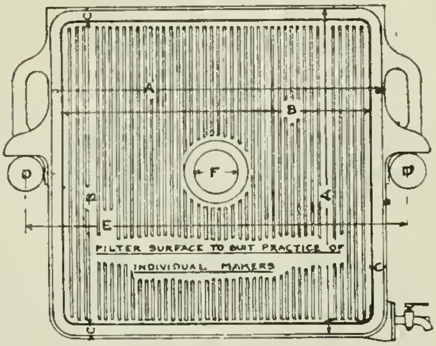
(2) Is the range of sizes sufficient for your requirements?

(3) Are you in agreement with the four sizes proposed?

The Committee will welcome any helpful criticism and comment from any interested parties. Communications should be addressed to the Association of British Chemical Manufacturers, 166, Piccadilly, London, W. 1.

PROPOSED STANDARD FILTER PLATES.

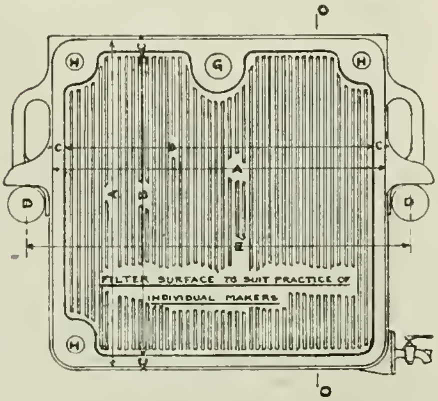
Handles to suit individual makers.
Recessed plate, non-washing.



Filtrate-taps to have standard facings and cleaning-type nozzles.

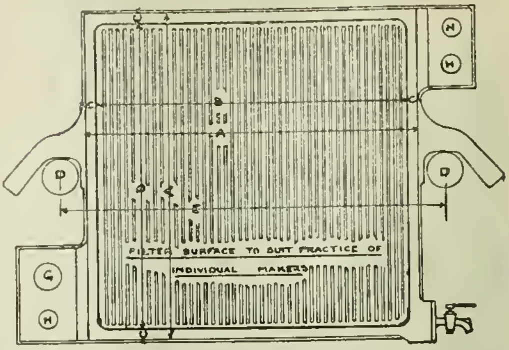
Section at O.O.

Plate and frame, wash-type, with internal lugs.



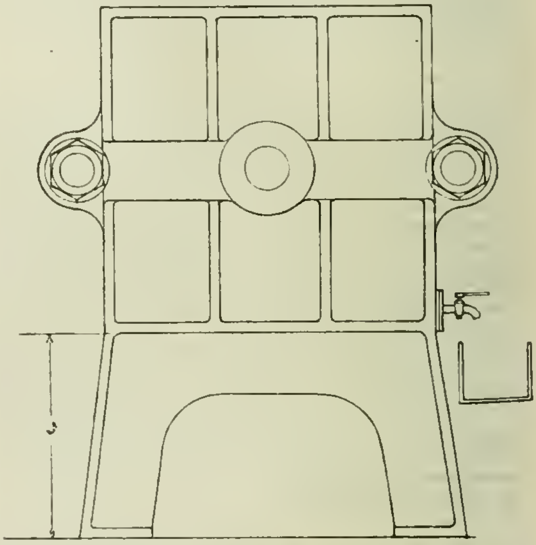
Filtrate-taps to have standard facings and cleaning-type nozzles

Plate and frame, wash-type, with external lugs.



Filtrate taps to have standard facings and cleaning-type nozzles.

Diagram showing height from floor to underside of plates.



General Dimensions.

Parts.	Reference letter.	Nominal size of press.			
		19″	25″	32″	38″
Outside of plate (measured to outer edge of tooled rim) ..	A	18½″	25″	32″	38″
Size of cake (measured to inner edge of tooled rim) ..	B	17″	22¾″	29⅝″	35½″
Width of rim ..	C	¾″	1⅛″	$1\frac{3}{16}$″	1¼″
Diam. of side rods ..	D	2½″	3½″	4″	4″
Centres of side rods..	E	23⅜″	30⅜″	37¼″	44″
Diam. of feed-passage in recessed plate ..	F	3″	4″	4″	5″
Diam. of feed-passage in plates and frames	G	1¼″	1¾″	2⅛″	3″
Diam. of wash- and air-passages ..	H	1⅛″	1½″	1¾″	2″
Clear height from floor to underside of press-plates (minimum) .	J	19″	21″	24″	24″
Diam. of feed-valves, plate and frame ..	*	Screwed 1½″	Screwed 2″	Screwed 2½″	Flanged 3½″
Diam. of wash-valves, plate and frame ..	*	Screwed 1¼″	Screwed 1½″	Screwed 2″	Screwed 2″
Sizes of filtrate-cocks	—	⅝″	⅝″	⅝″	⅞″

* Screwed valves may be fitted with loose flanges.

NEWS FROM THE SECTIONS.

EDINBURGH AND EAST OF SCOTLAND.

The first ordinary meeting of the present session was held on October 25, in the Hall of the Pharmaceutical Society, 36, York Place, Edinburgh, when the chairman of the Section, Dr. H. E. Watt, delivered an address on "Industry and some National Financial Problems." After tracing the development of the present economic situation, and showing its connexion with the creation of vast war credits, Dr. Watt referred to the serious question involved in regard to funding our floating debt and dealing with maturing obligations. These, he suggested, should be gradually dealt with through the medium of annual compulsory loans, bearing a moderate but equitable rate of interest, to which should be added a redemption premium sufficient to extinguish the capital sum in 100 years; by this means the process of deflation would be gradually brought about and our total indebtedness liquidated in 170 years. For the present, he advocated acquiescence in the state of deflation on account of the seeming impossibility of otherwise balancing our national accounts.

NEWCASTLE.

At the meeting held on October 26 Dr. J. T. Dunn presided in the unavoidable absence of Dr. J. H. Paterson, and Dr. G. Weyman read a paper on "The Rate of Carbonisation of Coal."

The method used in the investigation was to observe the rate of gas-yield when a known amount of coal in a steel tube was plunged into molten copper (or lead) contained in a calorimeter. A series of experiments was made on the influence of various sizes of coal, alone and in admixture, on the rate of carbonisation, and it was found that mixtures of two sizes gave rates approximating to the mean of those of the components when the sizes were not widely separated. Mixtures of all sizes, however, gave rates that depended largely on the difference between the maximum and minimum sizes, the highest being obtained when the mixtures contained both large and small particles. The rate of carbonisation was greatly affected by a slight variation in the amount of any one grade present in a mixture of several sizes, and was substantially diminished by the presence of small amounts of dust, especially when the coal was evenly graduated in size. It was shown that the size of particle was extremely important, for with increasing sizes of particle the impervious plastic layer formed on heating coals that yielded adherent coke became less continuous, thereby offering less hindrance to the transference of heat by the gases, so that carbonisation was more rapid. The increase in the rate of carbonisation due to increase in size of particle was limited, however, by the need for preliminary heating of a small layer of coal by conduction, which required the coal to be in contact with the heating surface and necessitated the use of a particle of small size compared with the diameter of the retort. The size of the interspace in the charge was an important factor, as the transference of heat to the interior of the charge was most rapidly effected by the gases evolved, conduction being relatively slow and radiation still slower. Although a mixture of different coals generally gave a result that was a mean of the rates of component coals, the result could only be foretold by considering the composition of the coal used and the size of the particles mixed. For any size of particle, coal could be classified in ascending order of maximum rate of carbonisation, starting with coking, gas, cannel and terminating with non-coking coals.

GLASGOW.

At a meeting of this Section held on October 27 in the Institute of Engineers and Shipbuilders, Glasgow, Mr. S. H. B. Langlands presiding, a paper entitled "Leaves from the Notebook of a Research Chemist" was read by Mr. R. F. Stewart.

The relationship of chemistry to other sciences and to practical life was discussed, and the astounding apathy and ignorance shown by the public towards a science of such widespread interest and of such vital national importance was emphasised.

A tribute was paid to a class of worker not often recognised to-day, a class untrained in chemistry, yet which had built up great industries in the past by dint of patience, perseverance, and accurate observation, and by using rule-of-thumb methods. In not a few cases these workers had laid down the lines of processes that have not been greatly changed even to-day. There are many industries even now in which the wise chemist treads warily, knowing that science has not yet overtaken practice founded on years of patient experience.

Mr. Stewart pointed out the increasing importance of the study of physical chemistry, both in pure and applied chemistry. The value of such instruments as the spectrograph, the polarimeter, and the refractometer was indicated, and the appreciation in industry of such principles as Le Chatelier's theorem, the law of mass action, and the phase rule was noted. In particular, the author mentioned that the realisation of the profound influence of the size of particles and their physical condition on chemical behaviour had borne much fruit. The lines along which emulsions are studied were then discussed in detail, and the importance of surface tension measurements was indicated. An emulsion is a highly energised system by virtue of its development of surface and by its rapid motion due to its globules being electrically charged adsorption centres. For example, emulsified cresylic acid is much more strongly germicidal than cresylic acid in solution.

The author drew attention to the recent advocacy by Sir William Pope of the intensive exploitation of the tropics. The rendering of these regions less deadly to the white man is an important immediate problem, and in the struggle against the terrible parasitic diseases prevalent there the molecular physics of disinfection will no doubt prove a good ally.

BIRMINGHAM.

At a meeting held in the University Buildings on November 3, the following papers were presented by Prof. G. T. Morgan and his collaborators:—I. "5-Amino-1:2-naphtho-*p*-tolyltriazole": G. T. Morgan and S. Chazan. II. "Methyl-β-naphthylamine-6-sulphonic acid": G. T. Morgan and H. S. Rooke. III. "The Employment of a New Group of Naphthalene Intermediates in the Production of Azo- and Disazo-Dyes": G. T. Morgan and H. Gilmour.

I. In the research for derivatives of α-naphthylamine suitable for use as middle components of poly-azo-dyes, β-naphthylamine was converted successively into 5-nitro-β-naphthylamine, 1-toluene-*p*-azo-5-nitro-β-naphthylamine and 5-*nitro*-1:2-*naphtho*-p-*tolyltriazole*. The new nitrotriazole was then reduced to 5-*amino*-1:2-*naphtho*-p-*tolyltriazole* in the hope that this α-naphthylamine derivative would give rise to diazotisable para-azo-compounds, but it was found that the triazole group exerted steric hindrance on the adjacent 8-position so that entrant diazo-radicals took up position 6 giving rise to ortho-azo-compounds. Hence the new base, 5-amino-1:2-naphtho-*p*-tolyltriazole, although unsubstituted in the para-position with respect to the amino-group is nevertheless not utilisable as a middle or end component of complex azo-dyes. Its sparingly soluble diazonium chloride can, however, be employed as a first component of these colouring matters.

II. This paper illustrates certain technical improvements recently effected in the manufacture of intermediates of the naphthalene series. Methylamine hydrochloride is now an article of manufacture and this reagent heated with β-naphthol-6-sulphonic acid (Schäffer acid) and aqueous caustic soda in the rotating autoclave at 180°—200° C. under about 17 atm. pressure leads directly to the sodium salt of methyl-β-naphthylamine-6-sulphonic acid (methyl Brönner acid), an intermediate utilisable in colour production. Certain of these colours and other derivatives of methyl Brönner acid are described in the paper.

III. One of the authors had previously prepared by circuitous methods a new group of substituted α-naphthylamines suitable for use as middle and end components of poly-azo dyes. It has now been found possible to obtain these substances by the direct method outlined in the preceding abstract. β-Naphthol is thus converted into methyl-β-naphthylamine, and its sulphonic acids such as Schäffer acid are similarly transformed into the corresponding methyl-β-naphthylamine-sulphonic acids.

Methyl-β-naphthylamine and methyl-β-naphthylamine-6-sulphonic acids are converted into their arylsulphonyl derivatives. These compounds are then successively nitrated and reduced, thus giving rise to substituted α-naphthylamine derivatives containing the group $N(CH_3).SO_2Ar$ in the ortho-position to the amino-group. These compounds are not only diazotisable but they are also capable of coupling with diazonium salts. Hence they can be used as first, middle, and end components of poly-azo-dyes. As compared with α-naphthylamine itself, they give brighter shades of colour, some of the effects on silk being especially striking. The resulting dyes are well-defined crystallisable substances readily isolated in a state of purity.

The new substituted α-naphthylamines which contain sulphonic groups and are readily diazotised under works conditions in aqueous solutions, represent a technical improvement over the older members of the series in which these groups are absent.

MANCHESTER.

A joint meeting with the Chemical Engineering Group was held at the Textile Institute on November 4, when Dr. Ardern presided, and a paper on "Electrical Precipitation" was read by Dr. H. J. Bush.

In describing the history of the process, Dr. Bush stated that the first systematic investigation of the influence of electric fields on the removal of suspended particles from gases or vapours was made by Sir O. Lodge, who in 1885 applied his method to the electrical precipitation of lead fumes. As the electrical equipment was deficient the work was abandoned and nothing was done until 1906, when Dr. F. G. Cottrell applied Lodge's method to the removal of acid mists in the contact process for sulphuric acid. The results being encouraging, the method was tested at the Pinole (California) works of the Dupont Co., and afterwards applied on a large scale by the Selby Smelting and Lead Co. to treat acid fumes arising from parting kettles. Dealing with the phenomena of conduction of electricity through air, it was stated that Ohm's law did not hold good and that after a certain potential difference had been established, raising the voltage would not increase the current passing, as the conductivity of the air-gap was limited by the number of ions present between the electrodes. Above a certain point ionisation was induced by the potential difference and the gas then conducted as well as a good electrolyte. Descriptions were given of the plant used in electrical precipitation and of methods for overcoming difficulties due to high initial ionisation of gases. The construction and operation of various plants were described, including the Queen's Ferry plant, the Admiralty plant at Holton Heath (both of the plate and rod type), a pipe and wire installation for recovering precious metal dust, the plant erected for the Skinningrove Iron Co., plant for cleaning gases from mechanical pyrites furnaces, and various plants in America and Japan. The possibilities of the method, where applicable, were stated to be enormous and its commercial advantage undoubted (*cf.* J., 1918, 389 R).

LONDON.

Mr. E. V. Evans presided at the opening meeting of the new session, which was held at Burlington House, W., on November 7. After he had referred to the loss of Mr. E. J. Bevan, and given a short *résumé* of recent events in the Society's history, he called upon Mr. N. E. Rambush to read his paper entitled "Comparison between Laboratory Fuel Tests and Practical Working Results of the Gas-Producer Process." This paper was a continuation of that read before the Section on May 2 on "Thermal Losses in the Gas-Producer Process" (*cf.* J., 1921, 129 T).

The author described the special type of fuel-testing apparatus which he uses in the laboratory of the Power-Gas Corporation, Ltd., Stockton-on-Tees, and which mainly consists of a gas-heated retort with a condensing train. All the products obtained by distilling the fuel, such as coke, gas, tar, liquor, oils, and ammonia, are separated and a weight and thermal balance made of the test. A large thermal loss occurs when distilling fuels rich in oxygen, but in the author's view this loss can be made use of when carrying out complete gasification. The tar-yields of modern by-product gas-producers may be over 80 per cent. of the theoretical quantity in the laboratory tests, but the quality of the tar is lighter than that obtained in practice. The yield of ammonia in by-product gas-producers not only depends upon the quantity of steam introduced with the air, but also on the design of the plant. When a large amount of ammonia is obtainable from a fuel the thermal loss caused by the potential heat of the ammonia should be borne in mind. The author expects soon to be able to predict the quality of gas that may be obtained by gasifying any fuel without large-scale tests.

In the discussion Dr. H. G. Colman expressed the view that the results obtained by the author would have been even more valuable if he had used producer-gas (obtained from coke) for heating the fuel in his tests.

MEETINGS OF OTHER SOCIETIES.

SOCIETY OF PUBLIC ANALYSTS.

On November 2, in the Chemical Society's Rooms at Burlington House, W., Mr. A. Smetham in the chair, the following two papers were read:—

(I) "The Testing of Foodstuffs for Vitamins," by Dr. J. C. Drummond and Mr. A. F. Watson. Sooner or later analysts will have to consider seriously the standardisation of methods for evaluating foodstuffs as sources of vitamins. Unfortunately, chemical and physical methods are not yet available, and the biological method, which is the only serviceable one at present, is subject to various sources of error, especially those due to variability of response in individual animals and the influence of external factors, although these have been reduced by recent improvements in technique. Great care is necessary in preparing the "pure" foods for the basal diet.

The authors described in detail the procedure adopted in their laboratory and then discussed the testing of foodstuffs for the three recognised classes of vitamins and the results obtained. They also showed the value of the method in studying seasonal variation in the food value of butter and milk and indicated the significance of these new discoveries from the analyst's point of view.

(2) "An Improved Specific Gravity Apparatus," by Dr. C. B. Savory. The author demonstrated a new and efficient instrument which has a range from 0·2 to 1·9 and furnishes results to four decimal places without calculation.

ROYAL PHOTOGRAPHIC SOCIETY.

The twenty-fourth annual "Traill Taylor" memorial lecture, entitled "Aerial Photography and Photo-topography," was delivered on October 11 by Mr. L. P. Clerc. Dr. G. H. Rodman, president, was in the chair.

The construction of lenses for aerial photography, said the lecturer, had greatly advanced during the war, but the French were handicapped by lack of glass and could not compete with British and American opticians. The labours of Sir W. Pope and collaborators had equipped the British Army with colour-sensitive plates, but these were only employed by the French towards the end of hostilities. The importance of light-filters was demonstrated by slides, which showed the effects of haze produced by air molecules and moisture. A special apparatus had been constructed by the lecturer for producing artificial haze with the aid of which plates and films could be tested. Rapid between-lens shutters were now being evolved which were nearly as efficient as the focal-plane variety, but which gave no distortion.

Plates and films each had advantages and required separate types of camera. There were three general methods of holding the film flat, viz., by tension, by mechanical pressure against glass, and by atmospheric suction. The cameras themselves must be compensated for the low temperatures prevalent during flight. The English employed unshrinkable wooden framework, and the Germans metal, protected by heating coils. The cameras must be held at their centres of gravity and secured to the aeroplanes by shock absorbers, for which ordinary tennis balls were effective. On all photographs taken for mapping purposes it was necessary to record the orientation of the plate with regard to the axis of the lens and the plane of the subject.

A certain chemical technique was being standardised which included desensitisation prior to development and special precautions to prevent shrinkage of the paper positive.

Four papers were read at the meeting held on October 25, two of which dealt with the nature of sensitive silver haloid crystals, another with "Uniform Development," and the fourth "Reproduction in Photogravure."

Mr. F. C. Toye pointed out that the familiar *d* log *e* curve of a photographic emulsion was an expression of the different sensitivities of the individual haloid grains. If all grains had equal sensitivity, then a certain critical exposure to light would simultaneously render all grains developable. The *d* log *e* curve would then be parallel to the *d* axis. Was there any relation between crystal size, structure, and sensitivity? Prof. T. Svendberg had prepared emulsions of uniform grain to show that grains of similar form and volume were equally sensitive. The lecturer had carried the work further by devising means for selecting exactly similar crystals in such an emulsion, and had compared their relative sensitivity by statistical methods. Though working with an accuracy at least twenty times that hitherto obtained, he found the shape of the *d* log *e* curve was that of an unselected emulsion. The conclusion was that size and form were not the deciding factors.

Mr. J. Brooksbank then showed some photomicrographic slides depicting emulsion grains as seen through the microscope by white light, and by non-actinic red light, pointing out that in the former case dark crystals always appeared. Although the darkening was obviously due to light, the lecturer indicated that there was no known connexion between this and the production of the latent image.

The next paper, by Mr. Olaf Bloch, described a new method for the uniform development of dry plates. Development being a diffusion process, it was necessary to remove products of the reaction from the film and supply fresh developer. This could be accomplished by covering a roller squeegee, stripped of its rubber, with plush velvet, and lightly rolling the plate in two directions while in the developing dish.

Mr. H. Mills Cartwright read an important communication on the tone-rendering capabilities of photogravure. From a mass of technical detail the fact emerged that within the limits imposed by the colour of the ink and the paper support, the process gave a faithful tone-rendering of the subject copied.

PERSONALIA.

Mr. John McLeish has been appointed Director of the Mines Branch, Ottawa, as successor to Dr. E. Haanel, superannuated.

Dr. J. L. McKee, of Queen's University, Kingston, Ontario, has been appointed instructor in chemistry at the Royal Military College, Kingston.

The Council of the Chemical Society has appointed Dr. J. Irvine Masson to fill the vacant secretaryship of the Society caused by the death of Dr. H. R. Le Sueur.

Mr. E. R. Weidlein has been appointed to succeed Dr. Raymond F. Bacon as director of the Mellon Institute of Industrial Research. Mr. Weidlein, who is 35 years of age, has been closely associated with the Institute since 1910; he was Senior Fellow from 1912 to 1916, when he was appointed associate director.

Colonel Fred M. Gaudet, C.M.G., has been appointed Technical Executive Officer of the Canadian Advisory Council for Research. Colonel Gaudet, who was formerly superintendent of the Quebec Arsenal, organised the 22nd Canadian Regiment during the war. After service in France, he was called to superintend national munition plants in Great Britain.

Prof. A. Stock has been appointed director of the Kaiser-Wilhelm Institute of Chemistry, Berlin, in succession to Prof. Beckmann who has retired on reaching the age-limit. Prof. Stock has also been appointed commissioner for the execution of Article 172 of the Peace Treaty, by which the German Government is pledged to furnish information concerning certain chemicals and their methods of production. Prof F. Böck has been appointed professor of organic chemistry in the Technical "Hochschule," Vienna, and Dr. O. Keil professor of ferrous metallurgy and metallography in the corresponding institute at Loeben.

We much regret to announce the death, on November 8, of Mr. John Spiller, who was an original member of this Society and its only honorary life-member. Also of Dr. F. W. Passmore, consulting chemist, of Queen Victoria Street, London, who died suddenly on October 29, and Prof. F. E. Armstrong, who occupied the chair of mining in the University of Sheffield since 1913.

The death is announced from Washington, D.C. of Samuel S. Voorhees, chemist in charge of the Metals Section of the U.S. Bureau of Standards. The deceased was a member of this Society and took an active part in founding the American Society for Testing Materials.

Dr. J. W. Richards, one of the leading metallurgical engineers in the United States, and a native of Oldbury, England, died in Bethlehem, Pa., on October 12, aged 57 years. Dr. Richards was the first president of the American Electrochemical Society and its secretary from 1907 to the date of his death. He founded *Electrochemical Industry*, which later developed into Chemical and Metallurgical Engineering, and was also the author of numerous works, including "Metallurgical Calculations," a treatise on aluminium, and several translations.

We also regret to record the death, in California, of Dr. Arno Behr, in his 75th year. Dr. Behr was the first to develop the profitable manufacture of glucose, grape sugar, and mill starch in the United States. He invented processes for separating the oil-bearing germ of maize, for manufacturing corn oil and utilising the gluten as fodder, and for refining grape sugar without the use of alcohol. A full account of his work was given by Prof. C. F. Chandler, when presenting to him the Perkin Medal of the New York Section in 1909 (*cf.* J., 1909, 342).

NEWS AND NOTES.

CANADA.

Mining and Metallurgy.—*Copper.*—The Flin Flon mining property, in Northern Manitoba, has been investigated to a depth of 1000 ft. by a series of 43 drill holes and two shafts, at 200 and 300 ft. with cross cuts, and it is claimed that the average copper content is equal to $7.00 per ton. The estimated quantity of such ore is 25 million tons.

Nickel.—A company is being organised to develop the nickel properties in the Rainy Lake district of Ontario. Nickel Lake range is situated about 225 miles east of Winnipeg.

The International Nickel Co. has released 400 works at Sudbury. The refineries at Port Colborne, Ontario, and Bayonne, N.J., are closed temporarily, owing to accumulation of stock.

Iron and Steel.—It is reported that a whole valley of high-grade iron ore has been discovered on the shores of Lake Athabaska, analysing 64·36 per cent. of pure iron.

The iron and steel industry, which has been more or less slack during the year, shows some signs of improvement owing to the greater demand for rolling stock in the form of car wheels and trucks. The Algoma Steel Corporation, at Sault Ste Marie, has received an order for 32,000 tons of rails from the Canadian Pacific Railway, and the Dominion Steel Corporation, at Sydney, has been given a contract for 20,000 tons of rails by the Canadian National Railways.

Gold.—Gold telluride has been struck in the Dome Mine, Porcupine district, Northern Ontario.

The gold yield in the Yukon, including Canada and the United States, for the season 1921 is estimated at approximately $4,000,000, divided as follows:—Interior Alaska, $2,675,000; Yukon Territory, $1,250,000; Atlin, B.C., $75,000.

Hollinger Consolidated, one of the largest gold mines in the world, is to increase its capacity to 5000 tons of ore daily. The present output is 3200 tons, the monthly income about $900,000, and the dividend for the month of October was $246,000.

It is reported that the firm of Mitchelson and Co., of London, England, has acquired control of the Davidson Gold mine in the Porcupine field and will expend a large sum on development and milling equipment. The run of ore is reported to yield about 15 oz. of gold to the ton.

Gold, in paying quantities, has been reported to have been discovered at the following places:—Elbow Lake district, Northern Manitoba; township of Catherine, Northern Ontario in Boston Creek district; Beaver Brook, Northern Manitoba; and near Lake Duparquet in North-western Quebec, about 22 miles south of La Saare on the National Trans-continental Railway.

Coal.—The output of coal in British Columbia for the month of August was 251,361 t., of which 157,836 t. came from the Vancouver Island district.

A six-feet seam of high-grade bituminous coal has been discovered on the Anglo Coal Company's property on Kelly's Mountain, New Campbellton, Cape Breton. The coal is similar to that obtained from the Phalen seam near Sydney.

Tar-Sands in Alberta.—Renewed interest is being taken in the Northern Alberta tar-sands, and it is reported that several firms from the United States are taking options on a number of properties. These tar-lands all lie within a circle having a radius of 70 miles from Fort Murray, on the Athabaska river. The percentage of asphaltic material associated with the sand varies from 10 to 20. A recent investigation by Krieble and Seyer (J. Amer. Chem. Soc., 1920, 1337—49) shows that the Alberta asphalt contains more resin and oily constituents than that of Trinidad and Bermudez, and stands about midway between the hard and soft asphalts.

Petroleum Exploration.—Drilling for oil has been carried out very extensively in North-western Canada during the past season with results which have been far from satisfactory. Much of the optimism of last year has disappeared. The Fort Norman well is reported to have nearly given out, and boring has not shown indications of any more oil in that region. Considerable attention is being given to the Pouce Coupe oilfield lying on the boundary of Alberta and British Columbia, south of the Peace river. This field has been investigated by a number of geologists, who are optimistic of finding oil in quantity. The Imperial Oil Company is sinking a 21-inch hole on the Pouce Coupe river. It is anticipated that a producing well may be found at a depth of 1700 ft. This company is now drilling two wells in Saskatchewan, nine in Alberta, and four in the Mackenzie River district.

Miscellanea.—The Semet-Solvay Co. is planning the erection of a gas- and coke-oven plant at Hamilton, Ontario, early next year at a cost of $3,000,000.

The Transcona plant of the Canadian Creosote Co., which has been closed down for over a year, will resume operations at an early date. The plant employs 250 men and has a capacity of 1,000,000 railway ties per annum.

The Northen Explosives, Ltd., Dragon, Quebec, is commencing operations. It will manufacture blasting explosives of all kinds. The plant has been erected upon the site of the Curtiss and Harvey factory which was blown up during the war.

The $5,000,000 hydro-electric power plant at Twin Falls, Ontario, which is supplying power to the Abitibi Power and Paper Co., is completed. The generating capacity is approximately 28,000 h.-p. This additional power will enable the company to produce upwards of 500 tons of newsprint daily.

The Maguire, Paterson and Palmer Co. of Canada, the Diamond Match Co. of the United States, and Bryant and May, Ltd., of Great Britain, have joined in the foundation of a new Canadian match company which will erect a factory at Pembroke, Ontario. The company is at present exporting splints. The Diamond Match Co, will cooperate in the erection, equipment and operation.

FRANCE.

Industrial Notes.—*Importation of German Potash.*—The arrival of 15 trainloads of German potash has caused a great sensation in Alsace; six boatloads have also arrived at Douai and further quantities are expected. These deliveries have been made under a contract between the German Potash Syndicate and the Société Baignières et Dewisme, of Paris, which manufactures fertilisers. Owing to its reduced export trade, the German syndicate has accumulated vast stocks which are now on offer at fairly low rates. The French company claims that in making the contract it sought to benefit French agriculture by lowering the price of fertilisers; in any case the French Treasury will benefit, as the duty on imported potassium chloride is 30 fr. per metric ton.

In a lecture at Nancy, Prof. C. Matignon stated that the Alsatian potash mines, which covered 180 sq. kilometres, could supply the world's requirements for 300 years at the pre-war rate of consumption. The German mines with their 1500 sq. km. and 200 pits could supply the requirements for 7500 years, but from the standpoint of ease of extraction the advantage lay with Alsace.

Metallurgy.—The output of pig iron in France for the first half of 1921 was 1,800,424 metric tons, of which 32,837 t. was produced in the electric furnace; this represents a decrease of 13·2 per cent. compared with the second half of 1920. The steel produced during the same period was 1,537,634 t., or 16 per cent. less than in the previous six months. Like that of pig iron, the monthly output has steadily decreased. The outlook is not hopeful although production costs, salaries, and the price of coke have been reduced as far as possible to meet German competition.

Water Power.—Now that the scheme for harnessing the Rhone has received official sanction, operations will probably begin as soon as the financial situation improves. The scheme contemplates the production of 900,000 kw., of which 85 per cent. would be utilisable. The city of Paris has acquired an option on 200,000 kw., and the P.L.M. railway on a similar amount for electrifying its lines; the balance would be readily absorbed in the Rhone valley by Lyons, Marseille, St. Etienne, and Grenoble. It is also intended to make the Rhone navigable and to connect it by canal with the Rhine, thus bringing Marseille and Rotterdam into direct communication, and to irrigate 627,500 acres of rich soil. The cost of the whole scheme is estimated at 3500 million francs.

Rapid Determination of the Free Fatty Acids in Palm Oil.—Several firms exporting palm oil from Africa applied to the Institut Colonial de Marseille for a simple method of determining the percentage of free fatty acids in palm oil, suitable for use at the time of purchase of the oil from the natives. In response thereto a method that avoids the necessity for weighing or calculating has been worked out by A. Stieltjes. The method depends on the titration of the free fatty acids by means of $N/2$ sodium hydroxide and phenol phthalein in the usual manner, but the oil (assumed sp. gr. 0·09) is measured (after warming at 40°—50° C. to liquefy it, if necessary) in a special burette containing 7·8 c.c., and is then washed out of the burette into a 200 c.c. conical flask with 40—50 c.c. of neutralised alcohol; the free acids are then titrated with $N/2$ sodium hydroxide contained in a burette with 80 divisions, each of which represents 0·5 c.c. and therefore corresponds to the quantity of oil taken to 1 per cent. of oleic acid. The method gives results within 5 per cent. and allows an estimation to be carried through in about 5 minutes.

Arrangements have been made for the examination of samples of palm oil taken at the port of entry in France, and the results obtained compared with the results of examination in Africa should prove valuable in fixing both the price to be paid to the natives for oil and the sale price in Europe.

NEW ZEALAND.

Projected Manufacture of Pig Iron from Native Ore.—The Onahaka Iron and Steel Co. proposes to manufacture pig iron from the limonite which occurs close to limestone as a surface deposit in the Parapara district. The company possesses a blast furnace at Onahaka and is building coke ovens. It is estimated that the cost of ore at the smelter will not exceed 48 cents a ton and that the country's requirements would be met from a daily output of 30 tons of pig iron.—(*U.S. Com. Rep., Sept.* 20, 1921.)

AUSTRALIA.

Petroleum in Western Australia.—A definite announcement is expected shortly from the Government Chemist concerning the value of over 50 samples of possible oil-bearing matter which were sent to him for analysis by the Assistant State Mining Engineer and Geologist from the area (190×100 miles) licensed to the Freney (Kimberley) Oil Syndicate. Prospecting for oil is being prosecuted with great activity throughout the State. — (*Ind. Austral., Sept.* 1, 1921.)

Projected Pottery Industry in Western Australia.—During the past two years attempts have been made in Western Australia to discover a local clay suitable for the manufacture of pottery. Various kaolins have been tested and good results obtained in several cases, but the iron content of the clay generally proved to be detrimental to the colour of the product. Now, however, a suitable clay has apparently been discovered, and exhaustive tests are being made to determine whether it will fulfil all the requirements. A small but modern factory has been erected, and it is hoped that in addition to ordinary domestic pottery, sanitary ware and other classes of white earthenware will also be produced.—(*Ind. Aust., Aug.* 25, 1921.)

UNITED STATES.

German Potash for the United States.—According to *Die Chemische Industrie* (Oct. 24), the German Potash Syndicate has contracted to deliver 30,000 tons of potash (K_2O) to manufacturers in the United States. The amount is small because stocks in America are still fairly large and the demand is poor owing to the difficulty of selling agricultural produce. This applies, *inter alia*, to the cotton planters, but as the last cotton harvest was a poor one, it is expected that prices will rise and that the planters will pay renewed attention to the use of fertilisers. *Chemical and Metallurgical Engineering* (Oct. 19) states that the contract price approximates closely to the pre-war level, and that comparatively little business will be left to the French and American producers. The latter are unable to compete with the German product at the price offered, and they complain of the delay in the passing of the tariff bill as the cause of the contract going to Germany.

The Alunite Deposits in Utah.—In the *Compressed Air Magazine* (October, 1921), R. H. Tingley describes the vast alunite deposits in the Tushar Mountains, Marysvale, Utah, where the mineral ($K_2O.3Al_2O_3.4SO_3.6H_2O$.) contains 37 per cent. of aluminium oxide. Several companies are working these deposits, including the Florence Mining and Milling Co., which is developing 1780 acres. The alunite is blasted out and conveyed by chutes to plants at the foot of the mountain, where it is crushed and roasted. In roasting the alunite loses three-quarters of its combined sulphuric acid, the other quarter remaining with the potash to give potassium sulphate. The alumina is subsequently separated from the sulphate by leaching. The sulphur dioxide produced is highly concentrated and free from undesirable chemical constituents, so that it is well suited for use in the manufacture of sulphuric acid by the contact process. The Tushar deposits resemble those at Tolfa, Italy, but are much superior both in quality and extent. It is hoped that these deposits will furnish enough potash and alumina to meet all American requirements at prices low enough to overcome all competition, both domestic and foreign.

Proofing Cotton Duck against Water and Mildew.—Farmer's Bulletin No. 1157 of the U.S. Department of Agriculture contains an account of methods of waterproofing cotton duck and protecting it against mildew. The processes utilised fall under five headings:—(1) Those in which the resistance to water is due to insoluble metallic soap; (2) those which depend on a wax such as paraffin wax; (3) those that utilise bituminous materials, *e.g.*, asphaltum or tar; (4) those in which drying oils such as linseed oil are used; (5) various combinations of the preceding processes.

Silica in 1919.—The production of silica in 1919 amounted to 177,543 short tons, valued at $1,106,922, and comprised:—Quartz (vein quartz, pegmatite, and quartzite), 63,332 t.; sand and sandstone, 47,277 t.; tripoli, 24,292 t.; diatomaceous earth, 42,642 t. There was a small import of flint pebbles and flints, valued at $250,096. The uses to which the above forms of silica are applied include the manufacture of wood-filler, pottery, paints, and scouring soap, for polishing, in metallurgical and chemical processes, and in toilet preparations.—(*U.S. Geol. Surv., Aug.* 27, 1921.)

Barytes and Barium Products in 1919.—The barytes industry had a prosperous year in 1919, the quantity produced and sold being 89,647 short tons, worth $1,555,793, and representing an increase in quantity of 22 and in value of 49% compared with 1918. Georgia was the chief producing State, followed by Missouri, Kentucky, S. Carolina, and Virginia. Importation of barytes from Europe and of barytes products, mostly from Germany, recommenced late in the year. The domestic output of barium products was valued at $12,594,933, the chief products, in short tons, being:—Ground barytes, 57,985 t.; lithopone, 79,643 t.; and barium chemicals 20,013 t., including carbonate 7135 t., chloride 4509 t., sulphate (blanc fixe) 5227 t., and sulphide 1500 t. The output of lithopone increased by 15,627 t., owing partly to the revival of the paint industry after the war and partly to the increased use of barytes paints in place of more expensive lead or zinc paints.—(*U.S. Geol. Surv., July* 28, 1921.)

BRITISH INDIA.

Government Acetone Factory.—The demand for acetone for the manufacture of cordite in India became so pressing during the war that the Government decided to erect a factory in India for the production of acetone from grain by the bacterial process which had already been developed on a manufacturing scale in England and elsewhere (J., 1919, 271—282 T). The factory, which is situated on the Great Indian Peninsula Railway, at Nasik, in the Bombay district, is described by the superintendent, A. Appleyard, in the August number of the *Journal of Indian Industries and Labour.*

The factory is self-contained, inasmuch as, besides generating power, and pumping and filtering the water required, it disposes of factory and domestic effluents, and houses its staff and day labourers in an estate covering about 150 acres. Its water supply is drawn from the Darna River, three miles distant, where a pumping station, worked by electrical power from the factory, has been erected. The power plant of the factory comprises seven locomotive-type boilers with auxiliary plant, three horizontal cross compound engines, each capable of developng 212 B.H.P. per hour when run non-condensing, and three alternate-current generators. There is also a refrigerating house equipped with three double-acting ammonia compressors. The process plant includes a rat-proof store for 1000 tons of grain, a Robinson 4-pair mill, cookers of 3000 galls. capacity, in which the grain is heated at 130° C. for several hours, fermentation vessels of 20,000 galls. capacity, and two continuous stills each capable of distilling 1000—1200 galls. of wash per hour. The acetone from these stills is of 90 per cent. purity, and is subsequently rectified in a small pot still. The butyl alcohol distillate is salted out to give a 90 per cent. product.

It is stated that definite success was attained at the factory; over 100 tons of acetone and more than double this amount of normal butyl alcohol were produced, mainly from raw material not used for human consumption, viz., broken rice or *jowari.* A staff was trained and the factory put on a sound running basis, thus ensuring a supply of acetone for cordite manufacture in India (*cf.* J., 1920, 274 R).

JAPAN.

Nitrogen Fixation.—It is announced that the Japanese rights of the Claude process for producing synthetic ammonia have been acquired by a Japanese syndicate.—(*Chem. Ind., Sept.* 26, 1921.)

GENERAL.

Memorial to Lt.-Col. E. F. Harrison.—On November 2 the Secretary of State for War, Sir L. Worthington-Evans, unveiled a memorial plaque to the late Lt.-Col. E. F. Harrison in the Examination Hall of the Pharmaceutical Society at Bloomsbury Square, W.C. Mr. E. T. Neathercoat, the Society's president, recalled Colonel Harrison's great services to the country during the war and, in particular, his invention of the small box-respirator gas-mask, of which a total of 20 million was supplied to the British and Allied forces. He rose to the rank of Controller of Chemical Warfare, but in November, 1918, succumbed to pneumonia, repeated exposure to toxic gases during his experimental work having undermined his constitution. On behalf of the Army, the Secretary for War paid a tribute of respect and gratitude to Col. Harrison for his devotion and self-sacrifice, and said that the British Empire owed to science a debt which could scarcely be measured.—(*Cf.* J., 1918, 446 R; 1919, 417 R, 479 R).

New Uses for Rubber.—In their report on the prize competition for suggested new and extended uses of rubber, promoted by the Rubber Growers' Association (*cf.* J., 1920, 203 R), the judges state that the results were extremely disappointing. The number of competitors was nearly 2000, and that of the total suggestions about 10,000. Practically all the suggestions were forestalled by Goodyear in his work "Goodyear on Gum Elastic," published in 1855! The first prize of £1000 was divided among 114 competitors, who suggested the use of rubber sponge for upholstery, including the making of mattresses, but it is difficult to see how rubber could compete with flock and hair for these purposes, even at its present price of about 10d. per lb., and, moreover, its extended use for this purpose would not involve any appreciable increase in the weight of rubber consumed. Other suggestions for which prizes were awarded included the incorporation of rubber in a liquid form in paint for preserving wood and metals against corrosion by sea-water, and for general decorative and preservative purposes; for constructing valances and mudguards of motor vehicles; incorporation with cement; as a heat-retainer for hot-water cisterns; in place of putty for fixing glass; and for covering jars and bottles. The judges recommend that the suggestions be edited by some competent person, and that a handbook containing short particulars of the more useful ideas be issued and circulated among rubber manufacturers throughout the world.

Opening of the Sugar-Beet Factory at Kelham.—Sir A. Griffith-Boscawen, Minister of Agriculture, in opening the sugar-beet factory at Kelham, near Newark-on-Trent, on November 2, said it was remarkable that we had not produced sugar in this country before; there was no more reason why we should import sugar than milk and potatoes. He defended the Government's participation in the venture, but said he was no believer in what was called "farming from Whitehall." The factory has a capacity of 60,000 t. of sugar-beet for an anticipated annual production of 8000 t. of sugar, 3000 t. of dried beet pulp, and 1800 t. of molasses (*cf.* J., 1920, 15 R; 1921, 108, 198, and 219 R).

The Paper-Makers' Association.—Early in 1920 this Association established a Technical Section with the main objects of promoting the application of science to the art of paper-manufacture, of fostering the scientific and technical education of those engaged in it, and of encouraging research with a view to perfecting the processes and products of the industry. The Section has succeeded in enrolling practically all the engineers and chemists engaged in the manufacture as well as many "practical" paper-makers and individual firms, so that increased co-operation among them is only a question of time. The first volume of the Section's *Proceedings* will be completed by the issue of Part III. in December next. At a recent conference held in Edinburgh, at the Heriott Watt College, Dr. J. L. A. Macdonald read a valuable paper on "Fundamental Chemistry and Paper-Making," and Sir James Walker conducted the members over the new University Chemical Laboratories.

The Copper-Ore Deposits in the Shetland Isles.—In view of the project to reopen the old copper mines in the mainland of the Shetland Isles, a recent report by Dr. J. S. Flett, director of the Geological Survey for Scotland, is of timely interest. The deposits are found in the Old Red Sandstone of the Devonian Age, and extend from Rovey Head, north of Lerwick, along the eastern side to the extreme south of the mainland. Pyrites and chalcopyrite have been worked for copper at several places: the most important deposit is at Sandlodge, 14 miles south of Lerwick, where the main lode, consisting largely of siderite, is 9 or 10 ft. wide. This deposit was first worked at the end of the 18th century, but active development was not undertaken until 1872, and during the period 1872-1880 about 10,000 tons of iron and copper ore was raised. In 1880 the yield was 1995 t. of ore, valued at £5814, and 396 t. of iron ore valued at £344. Copper pyrites is known to exist at a number of other places, but Dr. Flett does not regard successful exploitation as at all probable. At the Sandlodge mine there is a possibility of success if modern methods of mining and dressing be used.—(*Min. Mag., Sept.*, 1921.)

Mauritius in 1920.—The Report of the Department of Agriculture, Mauritius, for 1920 states that considerable improvements have been introduced into the sugar factories and that the area under the crop has been extended by about 2000 acres to 172,752 acres. As cultivation and harvesting have been hindered by shortage of labour, attention is being paid to the use of labour-saving devices, such as tractors. Diseases and pests of the cane were less in evidence, and control measures have been applied extensively. Trials with new varieties of cane have been continued and manurial experiments have shown that applications of ammonium sulphate and sodium nitrate to cane dressed with pen manure may produce substantial increases in yield, but that these increases depend on other limiting factors; the commercial profit is a question of the relative value of fertilisers and cane. The production of alcohol from waste molasses was 366,520 galls.; the processes of distillation are inefficient, and there is scope for very large developments in the production of power alcohol, especially as the fertilising constituents of the molasses so employed can be returned to the land in the waste liquors. The sugar crop for 1920–21 is estimated at 258,900 metric tons, of which about 95 per cent. will be vesou sugar; the 1919 crop was 235,190 t.

A machine for preparing aloe fibre from *Furcroea gigantea* has given satisfactory results, but trials are being made to decide whether sisal, when properly cultivated, might prove more remunerative than *Furcroea;* in 1920, 3500 bales of aloe fibre was exported. Vanilla has been cultivated on a small scale but the crop has declined of late. Progress is being made in the development of tobacco growing; and an experimental area has been planted with limes. The coconut plantations are very promising, but there is still much room for development. Four salines are now being operated, and the total output of salt is about 1800 t. per annum.

Agricultural Industries in Seychelles During 1920.—*Vanilla.*—The export during the year amounted to 2832 kg., as compared with 3950 kg. in 1919, and an average of 5223 kg. for the last five years. In spite of much experimental work vanilla is attacked, in the Seychelles as elsewhere, by a host of diseases of which practically nothing is known. These diseases, coupled with low market prices, have caused the abandonment of vanilla culture in Seychelles, just as it has been abandoned in the West Indies, Mauritius and elsewhere. When vanilla is newly introduced into a country the crop is good, but after a period of years the same trouble always arises and cultivation has to be abandoned. Steps have been taken to study these diseases in Seychelles and to try to counteract their effects by manuring.

Coconuts.—The following crop is recorded for the year under review:—Nuts exported, 95,847; nuts converted into copra, 17,943,065; nuts converted into oil, 1,111,260; nuts consumed locally, 4,000,000. This crop compares favourably with the average crop for the last five years. The cleaning of the coconut plantations, which was made compulsory at the end of 1919, will ensure an increase in next year's crop. Soap manufacturing was stopped last year owing to the difficulty of getting raw materials, such as soda, from abroad.

Rubber.—The export of rubber during the year amounted to 24,040 lb., as compared with 30,000 lb. exported in 1919. Towards the middle of 1920 the slump in the price of rubber caused tapping to be stopped everyhere, and if the local price of rubber remains under R.1 per lb., there is no likelihood that tapping will be resumed. The cost of marketing is about 67 cents. per lb. Para rubber grows slowly in the poor soils of the colony, but the growth is quite good on alluvial soils. As all alluvial soils are planted with coconut palms, rubber has been relegated to the hillsides where the soil is poor, except in patches. This is detrimental to the cheap production of Para rubber, but the existing plantations, which have been cultivated for nine years in many places, need not be destroyed, for as they become older they will give a better yield.—(*Official.*)

The Utilisation of Cotton-Stalks.—The enormous quantities of cotton-stalks which are left after the cotton crop has been harvested are usually burnt as fuel, although they contain a fibre somewhat like that of jute. Attempts to extract this fibre have been made in Egypt and the United States, but unsuccessfully owing to the want of a satisfactory machine to work up the rough, irregular material. It seems unlikely that extraction could be made profitable on account of the low yield and the cost of handling, retting, and preparing the fibre. Trials with cotton-stalks as a paper-making material have been made in the United States, but the pulp was difficult to bleach and the results were not encouraging. More promising attempts were made at the Imperial Institute, where it was found that Indian stalks yield paper pulp of fair quality and bleachable to a pale cream tint; the yield of pulp was rather low and more caustic soda was required than for esparto, but large-scale trials are required to determine the commercial value of the material. Trials have also been made at the Institute on the dry distillation of cotton-stalks for the production of charcoal, pyroligneous acid, etc. The tar obtained was a thin, brownish-black liquid, the charcoal would rank only as a fuel charcoal, and the yield of acetic acid was rather below the average quantity obtained from hardwoods, but the yield of wood naphtha was about normal. The practicability of distilling cotton-stalks in India depends on the possibility of finding local markets for the products.—(*Bull. Imp. Inst., XIX., No.* 1, 1921.)

The Utilisation of Tripolitan Alfa in Italy.—The alfa grown in Tripoli has hitherto been exported exclusively to England for use in the manufacture of the finer grades of paper, previous attempts to use it in Italy having failed owing to lack of suitable pulping machinery. Now, however, as funds are available, the Minister of Industry has arranged that the question of the utilisation of Tripolitan alfa shall be investigated at the Royal Experimental Station for the paper industry and the study of vegetable textile fibres at Milan. The erection of suitable machinery is nearly complete, and tests on alfa cellulose will probably be started before the end of the year.—(*G. Chim. Ind. ed App., Aug.*, 1921.)

The Cement Industry in Dalmatia.—At the present time there are 6 cement works in Dalmatia, with a combined output of 500,000 metric tons per annum. The locality is an ideal centre for the industry as the raw material not only lies close to the coast but is of very good quality, containing a minimum of 76 per cent. calcium carbonate. Production was restarted in 1919, and profits varying from 25 to 40 per cent. were made during the year, despite the high price of coal. The factories are largely controlled by Italian capital, but it is reported that English capitalists have been negotiating for the purchase of some of the largest. Before the war Dalmatian cement was exported to eastern Europe and to South America.—(*G. Chim. Ind. ed App., Aug.*, 1921.)

Research Institute for Colloid Chemistry in Austria.—A research institute has been founded at Vienna for the investigation of problems in pure and applied colloid chemistry. The scientific section is housed in Prof. Pauli's laboratory, but the technical section is not yet organised. Papers published by the institute and, eventually, colloidal preparations are to be made available to persons interested.—(*Z. angew. Chem., Oct.* 14, 1921.)

German Chemical Works in 1920.—The diminished number of chemical plants in Germany in 1920, as compared with 1919, viz., 15,011 against 15,060, was chiefly due to the loss of factories in the Polish district. The number of full-time workers, however, rose from 294,766 in 1919 to 340,310 in 1920, their total working days from 88,231,447 to 101,890,802, and the total of wages and salaries from 1,131,682,109 marks to 3,538,857,777 mk. The average yearly wage was 10,003 mk., compared with 3612 mk. in 1919 and 1266 mk. in 1913. Accidents numbered 17,550, against 15,039 in the previous year. For the first time in the history of the industry the technical inspectors invited the assistance of representatives of organised labour (*cf.* J., 1920, 399 R).—(*Chem. Ind., Sept.* 12, 1921.)

Platinum Deposits in Germany.—The platinum found in Sauerland (Westphalia) occurs associated with sandstone and argillite in a matrix of greywacke, and its extraction requires the use of complicated washing-plant. Such plant has been erected near Olpe and Warstein in Westphalia. The greywacke contains 18—25 grm. platinum, 5—6 grm. iridium, 2—3 grm. rhodium, and 270 grm. silver to the metric ton, and its contents are therefore very valuable. It now only remains to simplify the process of extraction. The greywacke itself is a good material for road-making.—(*Edel-Erden u.-Erze*, 2, 20 (*July*), 1921.)

Nitrogenous Fertilisers in Germany.—The great depreciation of the mark has led to further considerable increases in the cost of wages, coal, and freights. The last-named have been raised by 30 per cent. as from November 1; a further increase in the price of fuel is in prospect, and the turnover-tax is expected to be doubled shortly. These increases have made it imperative to raise the prices of nitrogenous fertilisers, even of those which come under the Maximum Prices Order. The prices of cyanamide and of ammoniacal fertilisers have been raised by 20 per cent., and, on account of its greater cost of production, the price of pure sodium nitrate by 37 per cent.; but, at the present value of the mark, the old maximum price of German sulphate of ammonia is only one-fifth of the current price of Chile saltpetre, and the new prices of nitrogenous fertilisers will not be more than one-half of those now ruling in foreign countries. The home demand for nitrogenous fertilisers is still strong, but there is a grave shortage of railway trucks.

Although the disaster at Oppau will reduce the supplies of nitrogen compounds available for agriculture, the total German production in the current fertiliser-year will probably be greater than in the past year. The Nitrogen Syndicate hopes to meet all the orders already accepted, but at the moment it is refusing new orders, and export business has ceased.

Swiss Chemical Industry and Imported Alcohol.—The Swiss chemical industry depends largely upon imported alcohol, the home production being insufficient. About 60 per cent. of the imported supplies is derived from the United States, about 26 per cent. from the Dutch Indies, and the remainder from a variety of sources. Although American production of alcohol has experienced a set-back owing to the operation of the Prohibition Act, the attention of alcohol distillers having been diverted to the manufacture of other chemical products, it increased considerably during the war and has been aided by the growth of the chemical and pharmaceutical industries. The present annual production of about 60 million gallons is considerably greater than before 1914, but it is below that attained during the war period. It is suggested that the decrease in the American production of alcohol may adversely affect the Swiss chemical industry, and, in particular, the prices at which Swiss chemical products can be marketed, such prices being largely determined by the cost of imported alcohol. A well-established alcohol industry affords a means of protection in the event of the outbreak of another war, the plant employed being readily converted to other uses, and it is urged that in America's own interest the way-out from the difficulties originating in the operation of the Prohibition Act might be found in denaturing supplies of alcohol with various adulterants according to the subsequent mode of usage of such supplies, whether for medicinal, perfumery, or other purposes. A variety of considerations, however, clearly indicates that a solution of the problem is hardly to be anticipated along these lines, and, in its own interests, Swiss chemical industry is urged to make itself, once and for all, independent of imported supplies of alcohol by establishing an alcohol industry on a scale adequate to meet its requirements.—(*Schweiz. Chem.-Zeit., Sept.* 27, 1921.)

Reported Discovery of Oil-shale in Chile.—A large area of petroleum-bearing schist or shale has been discovered at Chucumata, about 24 miles south of Iquique; an exploiting company—the Compañia Nacional Petrolifera Luz de Chile—has already been formed.—(*U.S. Com. Rep., Sept.* 26, 1921.)

Chrome Ore in New Caledonia.—Chrome ore has been mined at several localities in New Caledonia, but at present production is limited to the Tiebaghi mine, Paagoumene, which is the richest mine in the country and one of the most productive in the world. Other deposits have been worked at La Coulée, Plum, and Carenage, all near Noumea, and at the Vercingetorix mine at Unia, which is now exhausted; unsold stocks at these mines total roughly 18,500 metric tons. Exports in 1920 were 91,536 metric tons, of which the Tiebaghi mine furnished 74,317 t.; of the total export the United States took 95, the United Kingdom 2·2, and Belgium 1·8 per cent. Shipments in 1920 were unusually heavy and as the American market is overstocked, exports in 1921 seem likely to be small. It is stated that the Société le Nickel proposes to manufacture ferro-chromium and ferro-nickel when its hydro-electric plant at Yate is completed.—(*Bd. of Trade J., Sept.* 15, 1921.)

PARLIAMENTARY NEWS.

HOUSE OF COMMONS.

Fertilisers.

Sir A. Boscawen, answering Mr. Gardiner, said that prices of fertilisers in the United Kingdom were no longer controlled by Government. Ample supplies were available, and as prices had been reduced considerably during recent months, he had no reason to suppose that unreasonable prices would be asked for fertilisers for next season.—(Oct. 24.)

Smoke from Factories (Committee of Inquiry).

Replying to Capt. Bowyer, Sir A. Mond stated that the only investigation carried out abroad by the Committee was on the occasion of a short visit by two members to certain industrial districts in Germany. The Committee was appointed in 1914 and its work was nearly done.—(Oct. 24.)

Disposal of Surplus Government Metal.

Answering various questions, Mr. Young said that the Disposal and Liquidation Commission had sold the entire stock of surplus metals in this country, amounting to 150,000 tons, to the British Metal Corporation for £3,650,000, and that storage of the stock at public expense would continue until December 24. It was not true that recent large re-sales of Government stocks of scrap non-ferrous metal had enabled foreign manufacturers to compete on specially favourable terms, as, on account of the cost of freight, British manufacturers could purchase more cheaply than their foreign competitors.—(Oct. 26.)

Poison Gas and the Peace Treaty.

In answer to Mr. Woolcock, Sir L. Worthington-Evans said that the military authorities were well acquainted with Major Lefebure's book, "The Riddle of the Rhine," and with the potential military value of the German chemical industry. No commercial ruling had been superimposed on Articles 168 and 169 of the Peace Treaty, regarding the manufacture of poison gas. The Inter-Allied Commission of Control was engaged in securing, by the inspection of over 7000 chemical factories, the observance of the conditions of those Articles, including the destruction or conversion of all plant specially adapted to the manufacture of poison gas.—(Oct. 26.)

Reparation Dyestuffs.

Replying to Major Barnes, Mr. Baldwin said that the German dyestuffs and intermediates requisitioned under the Peace Treaty were taken in the quantities advised by the colour-users' representatives. Owing to subsequent trade depression disposal had been much more gradual than was anticipated, but no complaints of deterioration in quality of the stocks had been received. Prices charged for reparation dyes had followed the prevailing market prices as closely as possible, but it should be noted that a substantial part of the reparation dyes was not at present manufactured in this country.

In answer to Lieut.-Com. Kenworthy, Mr. Baldwin said that owing to the trade depression and the limited demand, it was decided not to exercise for the time being the full option on the current production of German dyestuffs under the Reparation Clauses of the Treaty. That decision was not due to representations from British dyestuff manufacturers. The quantities now taken were determined after consulting the interests concerned, and with the Dyestuffs Advisory Licensing Committee, and were based on the estimates of requirements furnished by the representative organ of the colour-users.—(Oct. 31.)

Pig-iron Industry.

Sir R. Horne, in reply to Mr. Jesson, said he was not aware that a Yorkshire ironworks was losing about £1000 per week in the attempt to provide work by producing pig-iron for stock. No financial assistance could be provided by the Government in such cases, as the adoption of such a policy would throw immense liabilities on the Exchequer.—(Oct. 31.)

Magadi Soda Co., Ltd.

Answering Mr. G. Barker, Lieut.-Col. Stanley stated that the claim for compensation made by the Magadi Soda Co. against the Government for the use of the company's property during the war could not be submitted to arbitration.—(Oct. 31.)

Foreign Clinical Thermometers.

In answer to Mr. Jesson Sir W. Mitchell-Thomson stated that the National Physical Laboratory could not determine or certify the origin of clinical thermometers submitted for marking. The requirement of an indication of the origin of clinical thermometers would be dealt with in the Bill which was to be introduced to amend the Merchandise Marks Act.—(Nov. 2.)

Cement Trust.

Mr. Baldwin, replying to Mr. T. Thomson, said that the question of the cement trust was fully discussed in the Report on Cement and Mortar of the Committee established under the Profiteering Acts. The condition imposed by the trust that customers must not buy cement except from members of the trust applied only to merchants desirous of obtaining the maximum rebates. The Report stated that the price of cement had not been increased to an unreasonable extent; and recently the price of imported cement had been higher than that of the home product.—(Nov. 3.)

Safeguarding of Industries Act.

The following are summaries of answers given by the President of the Board of Trade to questions relating to the operation of the Safeguarding of Industries Act, 1921:—

Carbons.—All kinds of arc-lamp carbons are not dutiable under the Act; carbons for small dry cells were originally included but have now been removed.—(Oct. 24, 31.)

Electric-Lamp Filaments, etc.—Duty is chargeable on electric-lamp filaments as they are "manufactured products of metallic tungsten," but not on electric-lamp bulbs except when they are lamp-blown.—(Oct. 24, 31.)

Lamp-blown Glassware.—This term is used to describe glassware made with a blowpipe, in contradistinction to "furnace-blown ware." Glass containers for laboratory vacuum flasks come under the heading "scientific glassware," but the ordinary vacuum food-container is neither scientific glassware nor lamp-blown ware, and, therefore, not dutiable.—(Oct. 24.)

Optical Glass is defined as that type of glass, other than unworked spectacle glass, which is ordinarily used in imaging systems. Any attempt to define optical glass on the basis of physical constants is impracticable from the administrative point of view.—(Oct. 31.)

Lactose.—Crude lactose is not dutiable, but purer grades of B.P. quality are dutiable as fine chemicals. The Board of Trade has no power to exclude from the operation of the Act any commodity included in the Schedule, but the propriety of including any article can be put before the appointed referee, and a complaint regarding lactose has already been referred. Articles of food are expressly excepted only from the operation of Part II. and not from Part I., under which lactose of a certain grade of purity is dutiable. During the war the Board of Trade spent money on developing a section of this trade in order to utilise what was formerly a waste product.

Referee.—Mr. Cyril Atkinson, K.C., has been appointed referee to decide complaints under Section 1 (5) of the Act; he will hear cases in private, but his decisions will be published.—(Oct. 31.)

Medicinal Chemicals of Continental origin used in British hospitals come within the provisions of the Act; experience has shown the grave danger of depending upon foreign medicinal chemicals, and it is therefore inadvisable to allow hospitals a drawback on such articles.—(Oct. 31.)

German Proprietary Articles.—Many names of fine chemicals listed under Section 1 (5) are registered trade names of German proprietary articles, but the equivalent chemical designation of most of the names is also given. In certain cases British manufacturers can make and sell such products under the German trade names.—(Oct. 31.)

Synthetic Chemicals.—Representations have been made by the fine-chemical trade that about 75% of the synthetic chemicals imported into England is for export, and that most of these re-exports cannot be imported or exported by way of transit under bond. Regulations as to drawback to be made under the Act are being considered, and there is no reason to anticipate that they will prove unworkable.—(Oct. 31.)

Fire-Extinguishers.—A synthetic organic chemical contained in a fire-extinguisher is subject to import duty if obtainable in this country.—(Oct. 31.)

Menthol, which is not produced in this country, is included under the Act as a fine chemical. The question of the grades of menthol liable to duty is being considered.—(Nov. 4.)

GOVERNMENT ORDERS AND NOTICES.

Safeguarding of Industries Act.—The Board of Trade has received a formal complaint that Santonine has been improperly included among the articles chargeable with duty under the Act. The hearing of the complaint is fixed for November 26.

Zinc Concentrates.—The Board of Trade has ordered a supply of zinc concentrates from Broken Hill to be shipped to this country, and, if desired, will maintain supplies to meet the immediate requirement of smelters in the United Kingdom. All inquiries as to prices, terms, etc., should be addressed to the British Metal Corporation, 3, Abchurch Yard, E.C. 4, the Board's agent for the disposal of concentrates in the United Kingdom.

REPORTS.

Report on Economic Conditions in Rumania, dated April, 1921. *By* A. Adams, *Commercial Secretary to H.M. Legation, Bucarest. Pp.* 98. *Department of Overseas Trade. London: H.M. Stationery Office.* 1921. *Price 2s. 9d.*

The economic condition of Rumania has improved since the last report was issued (July, 1920; *cf.* J., 1920, 345 R), and although the trade balance is still very unfavourable, the future is hopeful. Predominantly an agricultural country, Rumania depends entirely on the cereal harvests to pay for imports and to feed her population, but agricultural production will not increase until the appropriated land has been definitively distributed.

The most important industries are petroleum, timber, sugar, and textiles, but there is considerable mineral wealth in Transylvania and the Banat, where from 500,000 to 700,000 tons of ore was treated annually before the war for the extraction of gold, silver, copper, lead, bismuth, and antimony. Bauxite is worked in Bihor county by two companies, the Magyar Bauxit r.t. (a branch of the Aluminium Industrie A.-G.) and the Aluminium Erez Banya es Ipar r.t. During the year the capital invested in the petroleum industry was increased from 540 million to 1326 million lei and many new companies were formed. Production rose by 113,686 tons to 1,034,123 tons of crude oil, from about 500 wells, but it will not attain the pre-war level until transport by rail and pipe-line and facilities for storage have been improved; the refineries were unable to work at full capacity owing to the lack of storage and sulphuric acid. The Rumanian sugar industry is practically owned by Belgian capital; a few factories have been repaired, but as the quantity of beet grown is insufficient, sugar has been, and is still being, imported from the West Indies.

The restrictions and taxes imposed on imports and exports, and particularly the export dues on petroleum products and cereals, have prevented the resumption of normal trade. Articles such as timber, hemp, oilcake, etc. offer a prospect to British importers, and the chief British goods which might find a market in the country include tinplate, black and galvanised plate, rubber and leather goods, coal, coke, chemicals, sulphuric acid, copper sulphate, caustic soda, ammonia, fats and oils, drugs and pharmaceutical preparations, paints, varnishes, colours, explosives, and sugar. By the Peace Treaty the area of Rumania has been more than doubled and the population increased from 7½ to 18 millions, so that this market should repay attention from British manufacturers, especially as Austrian and German competition has now partly disappeared. British exports to Rumania have increased in value from £2,018,160 in 1913 to £6,031,402 in 1919 and £7,496,169 in 1920. Exports from Rumania in 1920 included:—Petroleum residues, 24,100 metric tons; petroleum, refined, 148,423 t.; benzine, 54,324 t.; oils, mineral, 16,561 t.; oil, crude, 3500 t.; and paraffin wax, 83 t.

Report on the Commercial, Industrial, and Financial Situation in Japan, Dated June 30, 1921. *By* E. F. Crowe, *Commercial Counseller, and* G. B. Sanson, *Acting Commercial Secretary, H.M. Embassy, Tokio. Pp.* 80. *Department of Overseas Trade. London: H.M. Stationery Office.* 1921. *Price* 1s.

The year 1920 began with record prices, excessive speculation and over-trading, but the boom collapsed in April and thenceforward trade and industry were severely depressed. In June, 1921, there were distinct signs of betterment; the import trade revived, money was plentiful, and confidence reappearing. The export trade, however, was at a standstill, and the main obstacles to progress are excessive costs of production and the difficulty of finding overseas markets owing to the high exchange value of the yen (nominally 2s. 0½d., now about 2s. 5d).

Japan consumes large quantities of fertilisers, particularly ammonium sulphate for the rice crop. Whereas before the war this substance was imported almost entirely from Great Britain, in 1920 half the supplies came from the United States. Home production is increasing, but there is a good demand for British sulphate at 135—140 yen c.i.f. Japan for spring delivery in 1922. There are still big stocks of chemicals and drugs in the country, particularly of morphine, of which the import in 1920 was worth 12 million yen, and of "formalin," owing to the slump in raw silk, although this substance will be in brisk demand if it is more generally used for disinfecting bristles. Great Britain is recovering the trade in caustic soda; formerly it supplied the entire import, but in 1920 only about 50 per cent., the other half being purchased in the United States. The home production, aided by a high protective duty, is increasing, but importations of soda ash from Africa and elsewhere will continue to be needed. The Hoshi Pharmaceutical Co., of Tokyo, which specialises in the manufacture of alkaloids and has a capital of 20 million yen, has purchased over 800,000 acres of land on the Pacific slope of the Andes in Peru, and is growing coca and cinchona for use in its factory at Tokyo.

The slump in the textile market affected the dyestuff industry, and although the value of imported dyes rose from 17·5 to 26·5 million yen, the trade was bad and the big stocks which accumulated are said to be in the hands of the banks, deposited as security for loans. The reparation dyes have also helped in the depression, but these are only being released in small lots. Germany's share in the import trade has again become predominant; the imports from that country from Jan.—June, 1921, were valued at 3·345 million yen, as against 0·245 and 0·851 millions from Great Britain and the United States, respectively. Many of the smaller Japanese dyeworks erected during the war have ceased business.

In the petroleum industry, the Nippon Oil Co. has been formed with a capital of 80 million yen to absorb the two largest undertakings, the Hoden and the Nippon companies. A project to institute a Government oil monopoly was unsuccessful. The rubber industry has been making great progress and will doubtless revive from the present slump. In 1919 there were 327 factories employing 11,000 workers and turning out goods valued at 32 million yen, of which 8 million yen was for tyres. Exports of porcelain and glassware have much diminished but the domestic demand has been good; Japanese window glass has been ousted from foreign markets by the Belgian. The heavy fall in the export of matches was due to renewed competition from Sweden, and diminished trade with China and British India. China is producing for itself, and import duties in India have seriously affected business. Imports of pulp, chiefly chemical, were very large, and in spite of considerable re-exportation, stocks were very heavy at the end of the year. Machinery for two new pulp mills was imported, but two mills were lost by fire. Trade in paper with the United Kingdom increased at the expense of trade with America, and business in photographic paper was better than in any other similar line.

The foreign trade of Japan was shared mainly between the United States (33%), the United Kingdom (31%), and China (20%). The American share was 11 per cent. greater than before the war, but the shares of the other two countries named have remained the same. Official statistics of imports and exports for the year 1920 include tho following items:—

Imports.

	Long tons. 1920.	Inc. or dec on 1919. %
Sugar	175,553	−34·6
Salt	410,209	−14·8
Leather	2,131	+79·8
Paraffin wax	16,122	+12·4
Rosin	16,246	+83·1
Caustic soda, soda ash	86,625	− 1·9
Coal-tar dyes	1,984	+60·4
Sodium nitrate	125,042	+95·6
Ammonium sulphate	70,918	−28·8
Paper pulp	46,434	+15·5
Phosphorus ores	288,868	+53·3
Coal	797,000	+13·9
Iron ore	651,869	+ 6·6
Iron, pig	343,075	+23·1
Rubber, crude	6,014	−43·8
Kerosene (galls.)	33,911,000	− 9·3
Glass	£63,600	+27·8*

Exports.

	Long tons. 1920.	Inc. or dec on 1919. %
Starch	23,206	−44·3
Sugar, refined	59,299	− 8·2
Oils, vegetable and fish	25,445	− 1·0
Camphor	592	−49·1
Menthol	218	+54·4
Cement	195,393	+15·5
Rubber tyres	2,726	+18·1
Matches (1,000 gross)	28,414	−31·6
Soap	£4,662	*
Pottery, glass, etc.	£5,578	+ 7·2*

* Calculated on basis of value.

The mineral output for 1920 is given in the appended table:—

Gold	oz.	247,819
Platinum	,,	258
Silver	,,	4,909,817
Copper	long tons	66,733
Lead	,,	4,107
Bismuth	,,	0·2
Tin	,,	197
Mercury	,,	2·6
Zinc	,,	15,463
Iron, pig	,,	164,766
*Steel	,,	9,055
Iron pyrites	,,	1,338,223
Chromite	,,	3,901
Manganese ore	,,	5,380
Tungsten ore	,,	155
Molybdenite, crude	,,	88
Arsenic	,,	916
Arsenic ores	,,	2,135
Phosphorus ores	..	92,393
Graphite	,,	1,112
Coal	,,	28,660,100
Lignite	,,	174
Asphalt	,,	6.814
Sulphur	,,	38.808
Sulphur ores	,,	27,440
Petroleum, crude	galls.	77,415,000

* Not including the output of the Imperial Steel Works or that of works using imported iron ore.

With the exception of gold, silver, tin, and mercury, the output of almost all the other minerals was lower than in 1919.

OFFICIAL TRADE INTELLIGENCE.

(*From the Board of Trade Journal for October* 27 *and November* 3.)

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W. 1, from firms, agents or individuals who desire to represent U.K. manufacturers or exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department and quoting the specific reference number:—

Locality of firm or agent.	Materials.	Reference number.
Canada	Drugs, fine and industrial chemicals, gums, waxes	363
Switzerland	Drugs	372
United States	Heavy chemicals, china clay, fertilisers, iron oxide, pig iron	375
Argentina	Heavy and fine chemicals, rubber goods	376
Argentina, Uruguay, Paraguay, Chile.	Iron and steel sheets	390
Mexico	China, glassware, paper	377
China	Metals	388

TARIFF. CUSTOMS. EXCISE.

Argentina.—As from January 1, 1922, the importation or sale of wax matches containing white or yellow phosphorus is prohibited.

British India.—A customs duty is now payable on exports of lac.

Denmark—Sugar and sugar-beet may now be exported.

France—Export prohibitions have been withdrawn from bauxite, which may now be exported duty-free, and home-grown oilseeds. The export of dephosphorisation slag is again prohibited.

Decisions as to the classification of certain articles under the customs tariff affect chemical products not specially mentioned, various metal products, preparations for polishing metals, non-alcoholic perfumery, and volatile oils.

France and Algeria.—The specific rates of duty on certain wares of glass have been replaced by *ad valorem* rates. Imported malt is now subject to an *ad valorem* duty of 15 per cent.

Germany.—Revised export duties came into force on November 1.

Hungary.—Goods which do not require an import licence include sugar-beet seed, alfa, margarine and edible fats, fatty oils, cacao butter, charcoal, celluloid, galalith and similar materials, various minerals, medicinal products, dyeing and tanning materials, tar, pitch, gums, resins, vegetable fibres, paper and paper pulp, rubber goods, leather, glassware, stoneware, earthenware, wares of iron, steel, and common metals, electric carbons, many chemicals, coal-tar dyes, colours, varnishes, certain fertilisers, glue stock, etc. Customs duties on goods not included in Lists A and B are subject to a surcharge of 5900 per cent. when paid in paper currency.

Italy.—Export licences are no longer required for copper scrap and lead waste.

New Zealand.—The sale or offer for sale of sugar not refined in New Zealand is prohibited unless each package bears the name of the country where the sugar was refined.

Poland.—Revised import duties on "luxury goods" affect wares of various metals, fine toilet soap, etc.

Rumania.—Export taxes on bitumen and medicinal plants have been fixed at 500 and 100 lei per wagon, respectively; caustic soda, ammonium sulphate, and "pertrax" (for cleaning boilers) are exempt from export tax.

St. Lucia.—A copy of the revised schedules of import duties and goods admitted duty-free may be seen at the Department. Goods produced or manufactured in the British Empire receive preferential treatment.

South Africa.—Recent customs decisions affect blood albumin, eggs, raw hide blanks, tin ends, and granulated tin.

Spain.—The quantity of olive oil which may be exported under the free *régime* has been increased from 30,000 to 48,000 metric tons.

Import duties are now payable on hemp, logs for making paper pulp, paper pulp, etc.

TRADE NOTES.

BRITISH.

Fiji in 1920.—The chief products of this colony are sugar, copra, and bananas. In 1920, 72,988 tons of sugar, 14,666 t. of copra, and 759,830 bunches of bananas were exported, compared with 64,348 t., 27,311 t., and 612,795 bunches, respectively, in the previous year. The flourishing coconut industry is extending, and the apparent set-back in the export was due to the fact that in 1919 large stocks were carried over from the record year, 1918. Experiments are being made on the drying and preserving of bananas. The rubber trees are yielding satissatisfactorily and the industry shows signs of being remunerative. Exports were valued at £2,896,448 and imports at £1,673,121. Of the total trade of the colony, 77·19 per cent. was with British Possessions, chiefly Australia, New Zealand, and Canada, and 5·78 per cent. with the United Kingdom. Although exports to the United Kingdom diminished, the value of the imports increased.—(*Col. Rep.-Ann., No.* 1080, 1921.)

Gambia in 1920.—The value of imports into Gambia during 1920 was £2,376,072, of which 73·4 per cent. represented imports from the United Kingdom, France taking second and the United States third place. Exports were worth £2,463,712, the chief items being 80,384 tons of groundnuts (U.K. 81·17%, France 12·85%), 408 t. palm kernels (U.K. 99·3%), and 17,018 hides. The export of groundnuts was the smallest since 1915.—(*Bd. of Trade J., Aug.* 25, 1921.)

FOREIGN.

German Chemical Trade, Autumn, 1921.—The general recovery of the home and foreign trade in chemicals which began in July has become more and more marked during the autumn. This revival is to be ascribed less to general economic causes than to the continued depreciation of the mark and its consequence, increased foreign buying. The activity of the home market is partly due to a genuine revival of demand, but partly to anxiety that prices may rise still further. The rise in the price of imported goods, also connected with the depreciated exchange-value of the mark, was 7·3 per cent. higher in July than in June; in 1920 the average price in July was 11·3 per cent. lower than in the previous month.

The home trade in dyewares, though still below the level of 1913, has been satisfactory, but owing to the protective measures adopted in foreign countries, and in particular to the "Sanctions," the export trade has been bad. All other chemical markets have been very firm; prices of such commodities as "hypo," sodium sulphide, potash alum, and caustic soda have been rising almost daily, and are now about 50 per cent. higher than they were in August; pharmaceutical chemicals are also rising in price. This remarkable development is due to foreign purchasing, particularly English and American, in anticipation of impending import tariffs. In comparison with this foreign demand, the home demand has been almost negligible. All the larger factories have been selling their output weeks ahead, and it is anticipated that the scarcity and high prices of technical chemicals will continue because almost all the firms are having trouble with their employees, who are demanding increases in wages up to 50 per cent.; and further, the most important commodity exported, potash salts, will be dearer owing to the recent decision of the Reichstag to increase their prices by 30—40 per cent., an action which will lead to a general rise in price of all technical chemicals. It is, therefore, probable that the trend of the market will be towards higher prices, at least so long as German prices are below those current in the world's markets.

On October 12 the Chemical Export Bureau passed resolutions to the effect that all exports to countries with an exchange-rate unfavourable to Germany must be invoiced in the foreign currency, and that all bills, etc., must be cleared through the Reichsbank. The gold premium, which was 900 per cent. in November, 1920, and 700 per cent. in May, 1921, is now 1900 per cent.

Markets for Paints in Latin America.—*Argentina.*—There is a fair demand for paint in Argentina, imports of paints, dyes, and inks being valued at $5,189,931 for 1919. Detailed statistics for that year are not available, but the imports in 1917, with the percentages supplied by the chief countries of origin were:—White lead 532 metric tons (U.S. 95%); ultramarine blue and green 790 t. (U.K. 96%); varnish 612 t. (U.K. 57%, U.S. 38%); enamel 150 t. (U.S. 47%); red lead 142 t. (Spain 36·2%, U.S. 35·9%, U.K. 22·5%); paints, powder or lump, 1272 t. (France 36%, U.K. 28%). Local manufacture of paint and varnish is confined to a small output in Buenos Aires.

Bolivia.—Imports of paint and varnish in 1919 were as follows:—Paints and varnishes in oil 13 t., in powder 88 t., in paste 12 t.; paints and varnishes (white lead, etc.) for buildings 214 t. The United States supplies about 50 per cent. of the imported paints and varnishes, but Germany is regarded as a strong future competitor.

Brazil.—Prior to 1914 the requirements in paints and varnishes were mainly supplied by Germany, but during the war the United States and Great Britain became the chief suppliers. The value of the import trade is small, being only $63,258 in 1919.

Chile.—Paint manufacture in the Valparaiso district is confined to one firm, which imports its raw material from England. Zinc-white paints are mainly imported from England, special varnishes, floor paints, and paints in small tins from the United States. Imports in 1919 were as follows:—White lead 13 t. (U.S. 97%); aniline paints 138 t. (U.S. 81%); zinc white 92 t. (U.S. 92%); enamel paint 160 t. (U.S. 95%); paste paints 1440 t. (U.S. 58%, U.K. 40%); liquid paints 651 t. (U.S. 56%, U.K. 42%).

Cuba.—The manufacture of paint and varnish is extremely limited and supplies have to be imported. The import in 1918–19 was worth $2,216,894 (U.S. 95%, U.K. 4%), and included natural pigments 513 t., paints with metallic base 522 t., other paints and dyes 478 t.

Dominican Republic.—Practically all the paints and varnishes used in the Dominican Republic are imported; of imports valued at $106,706 in 1919, roughly 95 per cent. came from the United States. The only European paints imported are white-lead preparations made by a British firm.

Guatemala.—Imports of paints and varnishes in 1920 were worth $105,631 and consisted largely of prepared paints from the United States. The chief import was 247 t. of ordinary prepared paints.

Uruguay.—Very little paint is manufactured in this country, and the main sources of supply are Argentina, the United States, and Great Britain. The chief imports of paints and varnishes in 1920 were:—White and red lead, 139 t.; other paints, in bulk, 602 t.; paints, prepared, 339 t.; varnish 64 t. (all weights are given in metric tons).—(*U.S. Com. Rep., Sept.* 5, 12, 1921.)

COMPANY NEWS.

British Glues and Chemicals, Ltd.—The first report of this company states that the total subscribed capital is £1,399,984, of which £1,350,000 was issued at the time of its inception in 1920, and the remainder has since been allotted in part purchase of the Lomas Gelatine Works, Ltd., of Plymouth. Land, premises, plant, etc., are valued in the balance-sheet at £769,921, and goodwill at £388,715; liquid assets of £613,000 compare with current liabilities of £226,292. The net profit for 17 months to May 31 last was £241,722, and after paying the preference dividend and writing off £57,879 for preliminary expenses, £149,872 is left to be carried forward.

British Glass Industries, Ltd.—At the second ordinary general meeting, held on October 5, Mr. G. E. Alexander, chairman, dealt at length with the finances of the company. Investments, loans, goodwill, etc. are valued in the balance-sheet at £3,050,334, a sum which does not represent their present-day value, and expenditure on land, factories, plant, etc. at £1,051,637. The issued capital is £3,659,709 in £1 ordinary shares; debentures and secured loans amount to £605,233; liquid assets total £185,834, against creditors £93,587; net loss for the year £23,217; reserve and contingency account £200,000; carry forward £91,136. An interim dividend of 10 per cent. was paid last autumn, and the share premium account, £2,450,000, has been absorbed by the issue of bonus shares and by transfer to revenue. There was a loss of £35,541 on the Canning Town factory, which started operations in July, 1920, but was closed down in January last owing to the slump in trade. Of the many subsidiary companies, profits were earned by Webb's Crystal Glass Co., and the British and Foreign Bottle Co., but no revenue was received from the Queensborough Glass Bottle Works (loss, £5369), the Sablière la Molloise Sand Pit (Belgium), the Patent Interchangeable Stopper Co., the Irish Glass Bottle Co. (which started operations in August, 1920), the Triplex Safety Glass Co., and the Colonial and Foreign Glass Industries, Ltd. The last-named company was formed in March, 1920, to acquire the colonial and foreign rights of the Fourcault and Daubenspeck patents, and recently the American rights have been disposed of successfully. The dividends received by the parent company from the whole of the subsidiaries was £109,563, but large sums were spent by these on extensions, etc. Every effort is being made to cut down expenditure, and there is no immediate prospect of improvement. Two furnaces were re-started at Canning Town on July 28, and these have produced 8½ million bottles, of which 5 millions have been sold and delivered.

REVIEWS.

Kolloidchemie und Photographie. *By* Dr. Lüppo-Cramer. *Second edition, completely revised. Pp.* 112. *(Dresden and Leipzig: Th. Steinkopff.* 1921.) *Price 7s. 10d. net.*

The successful practice of photography and, more especially, the manufacture of photosensitive materials are typical of those practical arts which call for an intimate acquaintance with the properties of matter in the colloidal condition, but appreciation of the importance to photography of recent scientific investigations in colloid chemistry was by no means common when the first edition of this book appeared in 1908. Dr. Lüppo-Cramer deserves congratulation on having been one of the earliest photographic investigators to appreciate the advantages of that close affiliation of photochemistry with colloid chemistry which is proving so fruitful. It is still unfortunately true that comparatively few photographic chemists in this country have much more than a hazy notion of the lines along which progress in the latter branch of physical chemistry is being made, whereas in Germany such knowledge would appear to be more widespread, if one may judge from the fact that the author gives this as the reason for omitting from the new edition the introductory chapters dealing with the elementary principles of colloid chemistry.

The remainder of the original book has also been drastically altered; many of the interesting examples culled from photographic practice find no mention in this edition, and practically all the new matter is provided from the author's own observations. As an elementary guide to the bearings of colloid chemistry on photography the book has suffered by these changes.

The pioneer studies of Carey Lea on the photohalides and colloidal silver are given the prominence which they merit, but few other English-speaking workers are mentioned. Lüppo-Cramer's experimental work is almost entirely qualitative in character and he persistently ignores the accurate quantitative work and the broader outlook of English and American investigators. For instance, in view of the fact that the minimum amount of light, as measured by the product of intensity and time, which will produce a latent photographic image is found to be inadequate to provide the energy required, on thermochemical grounds, to separate one atom of silver from one atom of bromine per exposed silver bromide particle, few British or American photochemists will agree with Lüppo-Cramer that:—" So soon as one acknowledges that . . . . . chemical development is a sufficient proof of the existence of nuclei, all efforts to explain the primary action of light on silver bromide otherwise than as a splitting off of bromine and a silver-nucleus formation become, to say the least, unnecessary " (p. 52); nor does it trouble him that, if the supply of energy in such minimal exposures is already inadequate to the task, it is no use ascribing to the colloidal silver, which is assumed to be present in the " ripened " grains of a high-speed emulsion, the function of a catalyst promoting the decomposition (p. 53), since " catalysis " cannot supply energy lacking in the stimulus.

Dr. Lüppo-Cramer is well known as a tireless experimenter, with a large fund of information concerning photographic phenomena, many of which he was the first to place on record. His contributions to the literature of the subject are so numerous and valuable and are scattered through so many journals that the thanks of all photographic chemists are due to him for providing this epitome of his views and results with full references to the original papers. It would, therefore, be ungenerous to criticise too severely his explanations of the phenomena he describes, especially as, in many cases, it is difficult to suggest any reasonable alternative at present. Suffice it to say that his hypotheses are usually so simple and definite in character that they almost always lead to further progress by stimulating both himself and others to test them experimentally.

To those engaged in photographic research, the book will supply much food for thought and abundant data for further investigations of an extremely interesting character.

F. F. Renwick.

The Electronic Conception of Valence and the Constitution of Benzene. *By* H. S. Fry. *Monographs on Inorganic and Physical Chemistry, edited by* A. Findlay. *Pp.* 300. *(London: Longmans, Green and Co.* 1921. *Price 16s. net.*

The knowledge respecting the constitution of the atom which has been obtained during the present century has made it possible to gain some insight into the nature of chemical combination, and the view that two types of chemical union exist, (1) the ionising valency, dependent upon electron transference, and (2) the non-ionising valency, dependent upon electron-sharing between the two combining atoms, is probably now widely accepted. In this book, however, chemical combination is regarded as being dependent upon electron transference only, although in the substances chiefly considered the chemical combination is exclusively of the non-ionising type. This presents a great initial difficulty to the acceptance of the author's views. In the chlorine molecule, for example, the two atoms are assumed to be respectively positively and negatively charged, and this is represented by the " electronic formula," $\mathrm{Cl}\overset{-}{\text{—}}\text{—}\overset{+}{\text{—}}\mathrm{Cl}$. Experimental support for this is seen in the production of hydrochloric acid and hypochlorous acid in the hydrolysis of chlorine, and all chlorine, which, as in the chloroamines, gives hypochlorous acid on hydrolysis, is regarded as positive chlorine.

The greater part of the book is devoted to the electronic formula for benzene. It is assumed that the six outwardly directed valencies alternate in electric character, so that three alternate hydergen atoms are positive hydrogen and the other three negative hydrogen. The application of this formula to the substitution phenomena is first considered. If substitutes which give an ortho-para-orientation are regarded as negative and those which give a meta-orientation as positive, a simple explanation is provided of many of the observed facts, for most of the radicals, such as the nitro-group, which can be introduced directly into the benzene molecule, are, on this hypothesis, positive. " When substituents are of the same sign or polarity they will occupy positions which are meta to each other; if two substituents are of opposite sign or polarity they will occupy positions either ortho or para to each other."

However, exceptions to this rule at once suggest themselves, especially in the case of the halogen derivatives; the dichlorobenzene, for example, formed by direct substitution should, on this theory, be the meta-compound. These difficulties are met by the hypothesis of " electronic tautomerism." Chlorobenzene is regarded as containing positive chlorine. This is shown by the electronic equation for its formation,

$$\mathrm{C_6}\overset{-}{\mathrm{H}}_5\text{———}\overset{+}{\mathrm{H}}+\overset{-}{\mathrm{Cl}}\overset{+}{\mathrm{Cl}}=\mathrm{C_6}\overset{-}{\mathrm{H}}_5\text{———}\overset{+}{\mathrm{Cl}}+\overset{+}{\mathrm{H}}\overset{-}{\mathrm{Cl}},$$

and is confirmed by its molecular volume, for the conclusion is drawn from the molecular volumes of the chlorobenzenes that the atomic volume of positive chlorine is about 2·6 units greater than that of negative chlorine. But to explain the formation of para-derivatives on further substitution the chlorine in chlorobenzene must be negative. Hence the electronic tautomerism

$$\overset{-}{C_6H_5}\overset{+}{Cl} \rightleftarrows \overset{+}{C_6H_5}\overset{-}{Cl}$$

is assumed, and it is supposed that of the two "electromers" that containing negative chlorine alone undergoes further substitution. The hypothesis of electronic tautomerism evidently gives great elasticity to the theory; at the same time, it largely deprives it of any power of prediction, and such a facile reversal of electric charge many chemists will find difficult to accept.

The theory appears to require a more sharply marked division into two classes of the members of a given series of compounds than in fact exists. In the chloro-compounds, for example, the chlorine in some is regarded as positive, in others as negative, but in view of the marked polarity of chlorine the difference in behaviour of the two types should surely be very great. Professor Fry gives as the chief distinction that negative chlorine in the benzene nucleus can be removed by hydrolytic reactions, whilst positive chlorine resists removal. Actually, however, instead of this difference being sharply marked, almost every gradation in readiness of hydrolysis is shown by the halogen derivatives of benzene, from the great resistance of the positively substituted chlorobenzenes on the one hand to the high reactivity of compounds like picryl chloride on the other.

The difference of chemical character associated with alternate positions in the ring in substitution-derivatives of benzene where the substituent shows strong polarity (as in the nitro-derivatives of benzene or in pyridine), in which the author finds important confirmation of his theory, has long been recognised. But it is surely more in accordance with the facts to look upon this alternating character as brought about by the introduction of the substituent rather than pre-existent in benzene itself.

Although all the views advocated in this work may not carry conviction, it contains much that is very suggestive; the arguments are developed with ingenuity, and organic chemists will find that the book is one that can be read with considerable interest.

W. H. Mills.

A Dictionary of Chemical Solubilities—Inorganic. *By* A. M. Comey *and* D. A. Hahn. *Second edition, enlarged and revised. Pp. xviii+1141. (New York: The Macmillan Co.* 1921.) *Price 72s.*

"Comey" is more than a mere dictionary of solubilities; owing to the complete character of the work and the very large number of original papers that have been consulted, of which the source is generally fully indicated, it has become a reference work in inorganic chemistry almost rivalling "Beilstein" and Richter's "Lexicon" in the organic division. It is indeed difficult to over-estimate the debt that chemists are under to the compilers of such records, or to picture the enormous labour entailed in overhauling the huge volume of past and current scientific literature to make the presentation inclusive.

In the preparation of the second edition Dr. Comey has had the assistance of Dr. Dorothy Hahn, the latter being mainly responsible for extracting the material available since the appearance of the first edition in 1895 down to the end of 1915, whilst Dr. Comey has edited the enlarged volume. Dr. Seidell's "Dictionary of Inorganic and Organic Solubilities," which has appeared meantime, covers a smaller field in inorganic chemistry than Comey's, dealing with the more important compounds only, with less detail and more restricted references. Whilst therefore the former is useful and sufficient for many practical purposes, it does not compete with the latter for research workers.

There is little to criticise in the arrangement. Many chemists would doubtless wish that the authors had broken with the tradition of the older dictionaries in respect to the haloid salts. The convenience of having all the cyanides, carbonates, sulphates, and other oxygen-containing salts, grouped together would be equally felt in the case of the chlorides, etc. The inclusion of a book-marker with direction notes and a list of contractions would, as in the case of Watt's work, save much reference to the explanatory preface. Nomenclature has been satisfactorily handled—indeed, some chemical dealers might with advantage revise their labels with the help of a copy. Many pages in the book draw attention to the need for further work. For example, aluminium in its behaviour towards nitric acid is described by different observers as, (1) not attacked even when concentrated and boiling, (2) slowly soluble in 27 per cent. acid, (3) easily soluble *in vacuo*, (4) not attacked by dilute or concentrated at ordinary temperatures, (5) very easily soluble, (6) slowly soluble.

But few blemishes have been noted. Menschutkin's table of the solubility of aluminium bromide in organic solvents is useless in the form given, and is better exhibited in Seidell. Voerman's table for potassium permanganate should have an explanatory note. Decimal points have here and there gone wrong, the solubility of calomel being given as 21 mg. per litre, instead of 2·1. In cases where salts undergo hydrolysis, with some separation of basic salt, the facts might well have been recorded.

A useful synchronistic table of scientific journals is included as an appendix.

W. C. Reynolds.

Die Physikalische Chemie in der Inneren Medizin. *By H.* Schade. *Pp. vii.+569. (Dresden and Leipzig: Th. Steinkopff.* 1921.) *Price 21s. net.*

This volume is perhaps of only indirect interest to most readers of the Journal, but it is noteworthy as evidence of the remarkable extent to which the data and concepts of physical chemistry are being applied in medical science. The three sections of physical chemistry which are set out as of special value in the rational study of physiological and pathological phenomena are those dealing with (*a*) the properties of solutions, (*b*) colloids, (*c*) the course of chemical change from the standpoint of velocity and catalysis.

The main portion of the volume is occupied with a discussion, on this physico-chemical basis, of such matters as inflammation, infection, diseases of the heart, lungs, nerves, and digestive organs. The author, who has himself made a number of contributions to this development of clinical medicine, maintains very strongly that all processes in the living cell, both in health and in disease, are based on conditions and changes which are essentially physico-chemical in character. The abundant evidence brought forward in support of this contention is very striking.

A valuable part of the volume is a description of those physico-chemical practical methods which are applicable more especially for biochemical and medical purposes.

James C. Philip.

OBITUARY.

E. J. BEVAN.

Edward John Bevan, son of Edward Bevan, of Birkenhead, born 1856, was educated at private schools. At the age of 17 he entered the laboratory of the Runcorn Soap and Alkali Co., and this initiation into chemical industry, followed by systematic discipline in science at Owens College (1877–79), qualified him as a technical chemist with the enthusiasm of the veritable "amateur." The meeting with C. F. Cross in the research atmosphere of Owens determined a friendship which early became one of collaboration, both proceeding from college to engage in research work in the cellulose industry, which provided problems of general scientific interest, inviting joint investigation. Bevan was for three years chemist at the Musselburgh Paper Mills (A. Cowan and Co.), and enjoyed the encouraging companionship of the director, R. C. Menzies; evidence of this was the joint production of the article on "Paper Making" in Spon's Encyclopædia.

As early as 1882 "Cross and Bevan" began to publish researches on "Cellulose" problems in the *Journal of the Chemical Society*—having determined upon a definitive adventure in development of the "pure science" of the subject. Coming to London, they found a centre of work at the Jodrell Laboratory, Kew Gardens, with the encouraging support of Thiselton Dyer, H. E. Armstrong, and Hugo Müller. Incidentally, research work was undertaken for Lawes and Gilbert on the cellulose basis of the grasses, and for George Fry, F.L.S., who was engaged with C. D. Ekman in pioneering the wood-cellulose industry. Removing from Kew, and under the exigencies of "ways and means," they added to their technical programme investigations of textile bleaching processes, viz., the Thompson process, the Hermite process, the Mather kier and process, of which there are records in the *Journal*. A correspondence with Georges Witz, of Rouen, on his "oxycellulose" researches led to collaboration on this subject. The Exhibitions under the South Kensington Technological Scheme provided new fields of work, and Bevan was actively engaged on soap and alkali problems as Member of Jury of the Health Exhibition, and his partner as special lecturer. Arising out of that work, a study of crystallised monosilicate of sodium with W. N. Bacon resulted in the industrial production of the compound "Alkasil"; and a study of the isomorphic relations of Na_2CO_3, Na_2SiO_3, and Na_2SO_3 with G. S. Johnson led to the production of mixed salts, *e.g.*, the carbo-silicate (Carbosil). The Colonial and Indian Exhibition involved much work in connexion with vegetable fibres ("Cellulose"), of which the results are recorded in the "Reports."

The period 1888–92 was marked by close systematic research on cellulose derivatives, and resulted in the discovery of the xanthogenic ester series (Viscose). The development of this discovery again brought to the fore the question of "ways and means," and Bevan decided to enter the field of "professional" chemistry. He was successful in his first application, securing the appointment of Public Analyst under the Middlesex County Council (1892), in which office he found scope for his best activities. In this serene atmosphere his capabilities developed more rapidly; the work was his opus maximum, and he brought to bear on it—with full espousal of its associated activities—the very best of his "genial" endowment. His record of professional distinction has been fully and generously recognised by his brother chemists: he was secretary and, in due course, president of the Society of Public Analysts; and as fellow, member of Council, and vice-president of the Institute of Chemistry he worked hard, with conscientious and real self-sacrifice, for the high aims of that institution.

Bevan's personal popularity in the world of chemists, who are trained to critical exactitude, remains as a moving tribute to a character which attracted the writer 42 years ago, and which has survived the "slings and arrows" of some of the aspects of fortune, with a fine record of positive attainment and achievement.

C. F. Cross.

PUBLICATIONS RECEIVED.

Cane Sugar. *By* Noël Deerr. *Second edition, revised and enlarged. Pp.* 644. *(London: Norman Rodger.* 1921.) *Price* 42*s.*

Laboratory Manual in General Microbiology. *Prepared by the Laboratory of Bacteriology and Hygiene, Michigan Agricultural College. Second edition. Pp.* 472. *(New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.* 1921.) *Price* 21*s.*

A Catalogue of British Scientific and Technical Books. *Prepared by a Committee of the British Science Guild. Pp.* 376. *(London: The British Science Guild,* 6, *St. John Street, Adelphi, W.C.* 2.) *Price* 10*s.*

Organische Chemie. *By* Prof. R. Pummerer. *Wissenschaftliche Forschungsberichte, Naturwissenschaftliche Reihe. Vol. III. Pp.* 182. *(Dresden and Leipzig: Theodor Steinkopff.* 1921.) *Price* 10*s.* 9*d.*

Taschenbuch für Gerbereichemiker und Lederfabrikanten. *By* H. R. Procter, *assisted by* E. Stiasny *and* H. Brumwell. *Translated by* J. Jettmar. *Second edition, enlarged. Pp.* 264. *(Dresden and Leipzig: Theodor Steinkopff.* 1921.) *Price* 5*s.* 7*d.*

An Oil Trade Calculator. *By* T. Howard Butler. *Pp.* 204. *(London: Scott, Greenwood and Son.* 1921.) *Price* 10*s.* 6*d.*

Chemical Warfare. *By* Brig.-Gen. Amos A. Fries *and* Major C. J. West. *Pp.* 445. *(New York and London: McGraw-Hill Book Co., Inc.* 1921.) *Price* 21*s.*

Gasoline and Other Motor Fuels. *By* C. Ellis *and* J. V. Meigs. *Pp.* 709. *(London: Constable and Co., Ltd.* 1921.) *Price* 60*s.*

The Practical Chemistry of Coal and its Products. *By* A. E. Findley *and* R. Wigginton. *Pp.* 144. *(London: Benn Brothers, Ltd.* 1921.) *Price* 12*s.* 6*d.*

Modern Gasworks Practice. *By* Alwyne Meade. *Second edition, rewritten and enlarged. Pp.* 815. *(London: Benn Brothers, Ltd.* 1921.) *Price* 55*s.*

Bulletin of the Imperial Institute. Vol. XIX. No. 2. 1921. *(London: John Murray.* 1921.) *Price* 3*s.* 6*d.*

Report on the Geology and Mineral Resources of the Serb-Croat-Slovene State. *By* D. A. Wray, *Geologist attached to the British Economic Mission to Serbia. Pp.* 104. *Department of Overseas Trade. (London: H.M. Stationery Office.* 1921.) *Price* 3*s.* 6*d.*

The Making of Reflecting Surfaces. *Discussion held by the Physical Society of London and the Optical Society. Pp.* 44. *(London: The Fleetway Press, Ltd.* 1921.) *Price* 5*s.*

Nos Usines Métallurgiques Dévastées, 1914—1918. *By a group of engineers, with an introduction by Prof. L. Guillet. Pp.* 234. *(Paris: Revue de Metallurgie.* 1921.) *Price* 25*fr.*

WHAT IS A "FINE CHEMICAL"?

C. A. HILL.

The term "Fine Chemicals" used to be employed very loosely, sometimes to signify synthetic organic substances, sometimes analytical reagents or research chemicals, and frequently in a sense more vague than either of these. In the early days of the war it became clear that fine chemicals were destined to fill an important position. In a paper read before the Society of Chemical Industry at its Annual Meeting, held in Edinburgh in 1916, Hill and Morson endeavoured to indicate the far-reaching importance of fine chemicals and to give the term a definite meaning. They used it in the comprehensive sense as including *all* fine chemicals, making laboratory chemicals one group, pharmaceutical (or medicinal) chemicals another group, and technical chemicals (chemicals used in the arts and industries) a third group. This terminology was adopted, and the classification amplified, by the Association of British Chemical Manufacturers thus:—"Fine chemicals—Analytical; Pharmaceutical; Photographic; Rare Earths; Synthetic Essences and Perfumes." This comprehensive use of the term "fine chemicals" has since been repeatedly urged and has met with general acceptance; recently it has received official recognition in the Safeguarding of Industries Act.

The operation of this Act has raised the necessity of deciding definitely whether a given chemical product is or is not a fine chemical, and has thrown into evidence the fact that it is by no means easy to give an accurate and logical definition of "Fine Chemicals."

It is clear that the term "Fine Chemicals" cannot be restricted to chemicals of the purest grade that it is possible to produce or that is known; but they must be pure enough or special enough to be so classified, for example, as of B.P. standard for a drug, and of A.R. standard for an analytical reagent. To carry this point and that of skilled labour to extremes, one may cite a specimen of metallic salt used for an atomic-weight determination; a substance of such a degree of purity would be prepared by the research chemist himself with his own hands.

It must be emphasised that percentage purity, by itself, is certainly no criterion of whether a chemical is fine or not; it may be 99·9% and crude—if the 0·1% be arsenic contaminating a medicinal chemical—or it may be about 80% and "pure," *i.e.*, fine, if the remainder is water or some other neutral and entirely inert diluent (*e.g.*, potassium carbonate B.P.). Often, it is really *freedom from impurities* which makes the chemical a fine chemical. A simple salt, such as ammonium chloride, may be practically chemically pure, and dirty—then it is not "fine"; but diamino-dihydroxy-arsenobenzene, even if dirty, would still be a fine chemical. Crude Epsom salts and magnesium sulphate puriss. B.P. do not differ greatly in percentage composition, that is, the difference is not great numerically, although it is great in importance. Barium sulphate as supplied to the paint trade might be very fairly pure, *i.e.*, it might test well over 99% $BaSO_4$, but yet be quite unsuitable for pharmaceutical use; for the latter purpose it has to be specially prepared as a fine chemical so as to be perfectly free from soluble barium salts.

It may be that a chemical is manufactured by recognised makers of heavy chemicals on a large scale and yet produced in a state of chemical purity of such a degree as to warrant, other considerations apart, its being classed as a fine chemical. Owing to the large scale on which it is manufactured, the process has become so standardised that the comparatively unskilled labour of the process worker, under a chemist who merely supervises, suffices to run the plant; and here the conditions of manufacture are such that the chemical ceases to be "fine." Commercial sodium bicarbonate may be taken as an example.

Substances in the infancy of their utilisation may be fine chemicals, on account of the small scale on which they are manufactured, and later on may become heavy chemicals. To put it another way, when the manufacture of a particular chemical attains a scale larger than that usually associated with fine-chemical manufacture, it may on the one hand remain a fine chemical, or on the other hand it may come to be regarded as a heavy chemical; this will depend upon whether its manufacture and refinement do or do not require intensive and highly-skilled attention on the part of trained chemists. For instance, on however large a scale they are manufactured, quinine, caffeine, saccharin, and vanillin remain fine chemicals; but if nickel sulphate came to be manufactured on the same scale as copper sulphate, or maltose on the same scale as cane sugar, then they would cease to be fine chemicals.

There is no doubt about the distinction between heavy and fine chemicals in the great majority of cases, but there are bound to be some difficult border-line cases, and here, in addition to the other attributes of scale of manufacture and skilled manufacture, the crux must be: Is the chemical of a specified degree of purity to meet special purposes?

Take the case of dyes. The writer has stated elsewhere (*cf.* J., 1920, p. 425 R) that "dyes constitute a group of fine chemicals so large and important that they are generally considered as a separate branch of chemical industry; actually, however, they cannot be thus divorced from the rest of the fine chemical industry." Many dyes are produced on a large scale in a state of comparative impurity and would therefore not be classed as fine chemicals; certain dyes are, however, made on a small scale by fine chemical manufacturers in a state of purity for purposes other than that of dyeing in the ordinary sense, as, for instance, stains, indicators, and so forth; in such cases these substances, although dyes, are undoubtedly fine chemicals.

As the present writer has stated before (*ibid*), in dealing with the "Present Position of the Fine Chemical Industry," the first classification of chemicals is into the Heavy and Fine. Hence, to the question: "When is a chemical a 'fine' chemical?" we may reply: "When it is not a 'heavy' chemical."

Pope, in "Science and the Nation," states:—"The products of the chemical industry as a whole may be divided roughly into two classes, heavy chemicals, which serve largely as raw materials in other branches of chemical industry, and fine chemicals, which consist mainly of finished products such as dyestuffs, drugs, photographic chemicals, and the like."

Woolcock, in a recent issue of the *Times Trade Supplement*, states:—"The most that can be said is that a 'fine' chemical is one which (1) is usually made in small quantities relatively to heavy chemicals; or/and (2) is of an exceptionally high degree of purity, or otherwise of special quality; and (3) requires skilled supervision in its manufacture." Into (2) we must read the *use* to which the chemical is to be put; and as additional, though occasional, features, (4) rarity and (5) costliness may be mentioned.

But a recital of the attributes of fine chemicals is not a definition of them. In the minds of those who have the necessary knowledge and who have studied the question, the conception of what is a fine chemical is definite though indefinable—a colloidal conception and not a crystallisable thought.

The first rule to which a definition has to conform is that it shall not contain the name of the thing defined. In stating this rule one is irresistibly reminded of the famous reply to the question, "What is an archdeacon?" "An archdeacon is a priest who exercises archidiaconal functions"! Somewhat similarly, fine chemicals are chemicals which are made by fine chemical manufacturers. This definition is not so utterly ridiculous as it would seem at first sight; because the methods of manufacture, the scale of manufacture, the plant commonly employed, the skilled labour and the highly skilled supervision necessarily employed in fine chemical manufacture are essential concomitants of fine chemicals. Makers of fine chemicals have ideas by no means vague as to what fine chemicals are.

We have to consider, then, these attributes of chemicals:—Scale of manufacture; conditions of manufacture; skilled labour; highly skilled supervision; rarity; high cost; high grade of purity; and freedom from impurities.

Each of these ideas contributes something to a general understanding of what fine chemicals are. We require, however, something more than a general understanding. Each is true of *most* fine chemicals, but none alone suffices for the difficult cases. The one idea which does run right through, and may be said to be crucial, is the idea that the chemical is to be put to some specific use and for that purpose must conform to some definite standard of purity.

The shortest description of a fine chemical which is in any way adequate is that it is a chemical, not produced as a "heavy" chemical, which is of specified purity for a specific purpose.

THE CLAUDE SYNTHETIC-AMMONIA PROCESS AND PLANT.*

J. H. WEST.

The Claude synthetic-ammonia process has this in common with the older Haber process, that it consists in effecting the direct combination of hydrogen with nitrogen under pressure and in presence of a catalyst to form ammonia; the predominant difference between the two processes lies in the much higher pressure used by Claude. This difference may seem at first sight rather an unimportant one, but it will presently be seen that, on the contrary, it is a most far-reaching and fundamental one, which entirely modifies the working conditions of the reaction.

In order to understand the primary considerations which led Claude to adopt pressures which had hitherto been undreamt of in industrial working, it is necessary to examine the conditions of equilibrium between nitrogen, hydrogen, and ammonia under various pressures and temperatures. Fig. 1 was prepared by Claude from his own experimental data, and shows very clearly that, for a given temperature, the proportion of nitrogen and hydrogen remaining combined under conditions of equilibrium increases rapidly with rise of pressure, and that the lower the temperature the higher is the proportion of combination.

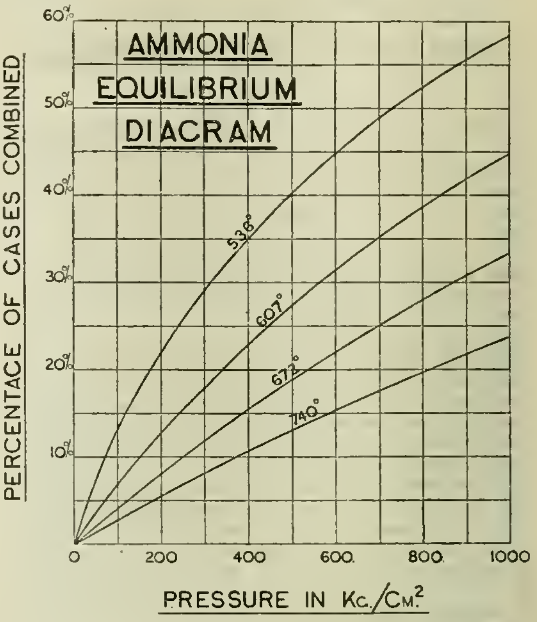


Fig. 1.

So far, the conditions for maximum combination would appear to be high pressure and low temperature, but in practice another consideration comes in, namely, speed of reaction. The lower the temperature the longer does it take to reach equilibrium, and in order to have apparatus of a reasonable size the reaction must not be too slow. Hence for practical purposes a compromise has to be made as regards the working temperature so as to get a reasonable speed of reaction combined with a sufficiently high proportion of combination of the gases. The useful range of working temperatures is found to lie between 500° and 700° C.

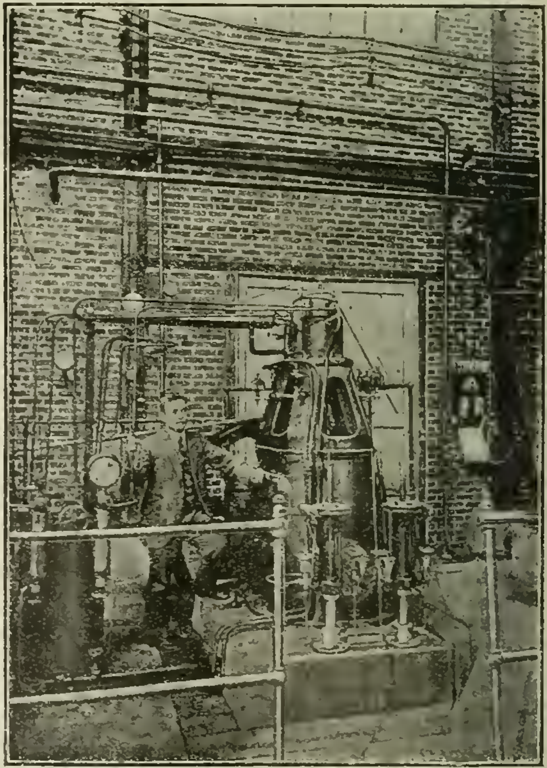


Fig. 2.

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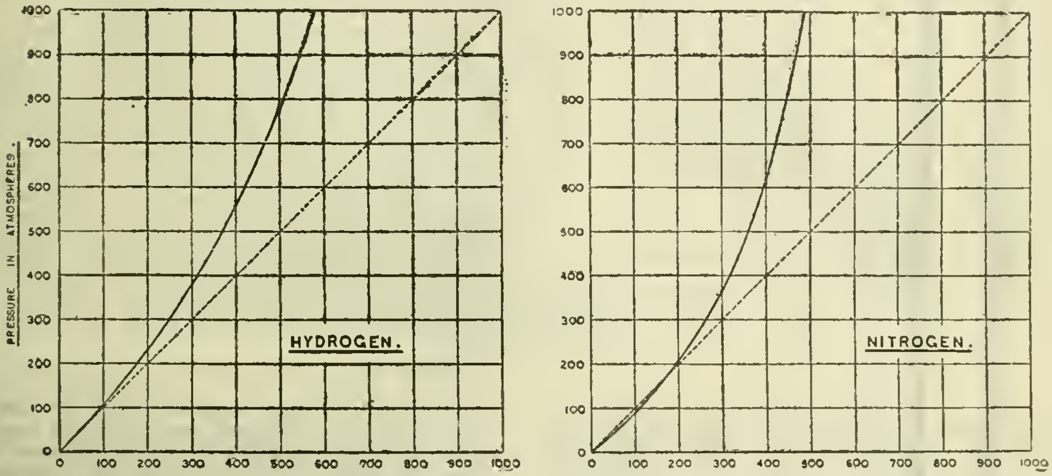
* Abstract of a paper read before a joint meeting of the Chemical Engineering Group and the Institution of Mechanical Engineers, at the Institution of Electrical Engineers, London, Nov. 22, 1921.

Claude finds it best to work at about 600° C., and he uses a pressure of 900 atmospheres, or nearly 6 tons per sq. in., as against the 200 atmospheres used by Haber.

The hydrogen and nitrogen, mixed in the proper proportions, are first compressed to 100 atmospheres in an ordinary three- or four-stage compressor, passed through separating bottles where any condensed moisture and oil from the compressor are drained off, and thence are led to the "super-compressor."

This is an exceedingly simple two-stage machine, capable of dealing with enough gas to make 5 tons of liquid ammonia per 24 hours, *i.e.*, a duty of 426 cb. ft. per minute.

Fig. 2 shows the compressor with M. Claude standing beside it. One of these machines has been running in France for some nine months past, and has given no trouble; in fact there are few compressors for 100 atmospheres which run so sweetly and silently, and with such freedom from vibration.



VOLUMES OF FREE GAS COMPOUND INTO UNIT SPACE AT VARIOUS PRESSURES,

FIG. 3.

With regard to the power consumed in compressing to these super-pressures, and bearing in mind that the power varies as the logarithm of the pressure difference between intake and delivery, it will be evident that the power required to compress from 100 to 1000 atmospheres will be half that required to compress from 1 to 100 atmospheres, since the logarithm of 100 is 2 and that of 1000 is 3.

Attention may be called at this point to the very considerable departure from the gas laws of Boyle and Charles which are met with under these conditions. The curves in Fig. 3 show the volumes of nitrogen and hydrogen respectively which can be compressed into unit volume at various pressures, the dotted lines showing the corresponding volumes for an ideal gas. The expansion with temperature has not been determined above 200° C., but at 900 atmospheres constant pressure, a volume of hydrogen represented by 1000 when measured at 0° C. becomes 1449 at 200° C., whereas according to Charles' law it should become 1733.

The first result or consequence of working at super-pressures is that the pipework becomes very small. The pipes carrying the mixed nitrogen and hydrogen for a plant making 5 tons of ammonia per day are only 8 mm. bore, and the difficulty of making gas-tight joints and valves is thereby enormously reduced.

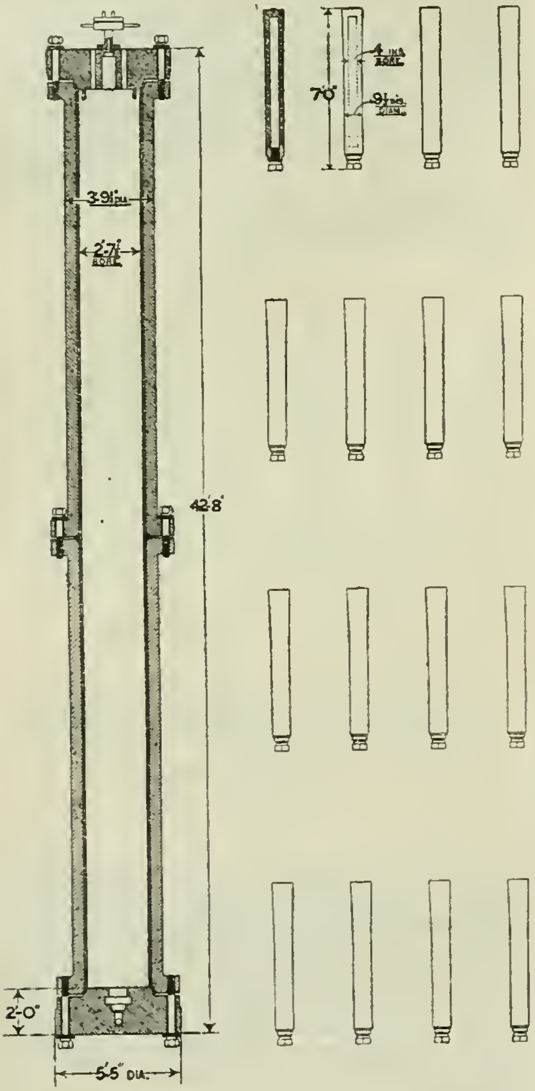
It has already been seen that the proportion of combination is much higher at 900 atmospheres than at 200, viz., about 42 instead of 13 per cent., and this has some very important consequences. The formation of ammonia is an exothermic reaction producing 717·6 calories per kg. of ammonia formed. When the proportion of combination is low, as it is at 200 atmospheres, the heat produced by the reaction is not sufficient to maintain the catalyst vessel and the incoming gases at the proper temperature unless the losses from radiation are reduced to a minimum by diminishing the radiating surfaces as much as possible. This fact compelled the Germans to devise enormous catalyst vessels, not simply for the sake of having large units, but in order to minimise loss of heat by radiation, and the preliminary heating up is done by injecting air and burning part of the hydrogen. The great cost of manufacture of these huge vessels, the difficulty of handling them, and the time lost in making the joints, can easily be realised.

Now at 900 atmospheres the conditions are quite different. The heat produced by the reaction then becomes sufficient to make it auto-thermic, so that no external heat need be supplied once the reaction has started. The reaction starts and stops quite suddenly; it does not begin gradually and build up, but starts as soon as the temperature is high enough, and goes on until for any reason the temperature falls too low or the activity of the catalyst becomes too feeble, when it stops with equal suddenness.

Under Claude's conditions, then, quite small catalyst vessels can be used, which can be heated initially by external electric circuits, and after that the problem is to get rid of the excess heat. The usual way of expressing the relative efficiency of catalytic reactions is in terms of grams of product produced per hour in each litre of volume occupied by the catalyst material. In the case of the Haber process this figure is about 350—400 grams, and in Claude's process it ranges from 5600 to 6700 grm.

Fig. 4 shows to the same scale the Haber catalyst vessel and the Claude catalyst tubes for a production of 20 tons of ammonia per day. The respective weights in the two cases are approximately 74½ tons and 11¼ tons.

Furthermore, in the Haber process, owing to the necessity for circulating the gas round and round over the catalyst, it is essential to have very large and complicated heat interchangers, in order that after each passage over the catalyst the gas may be cooled sufficiently to remove the ammonia and then be heated again to reaction temperature. The time required after a stoppage to get the whole Haber system heated is three days, whereas, starting all cold, the Claude plant will begin to produce ammonia in 4—5 hours.



HABER CATALYST VESSEL.

WEIGHT 74½ TONS.

CLAUDE CATALYST TUBES.

WEIGHT 14 CWT. EACH.

TOTAL FOR 16 TUBES: 11¼ TONS.

Fig. 4.

In the Claude plant there are four catalyst tubes, the first two of which are parallel, and the other two in series with the first two and with each other.

A simplo calculation shows that with such a system of four tubes, if a is the fraction of the gases which combine to form ammonia in each tube, the total combination in the system will be $a(3-3a+a^2)$, and working this out for $a=0{\cdot}42$, the total combination is found to be just over 80 per cent. On actual tests the observed proportion of combination has been found to be from 81 to 83 per cent.

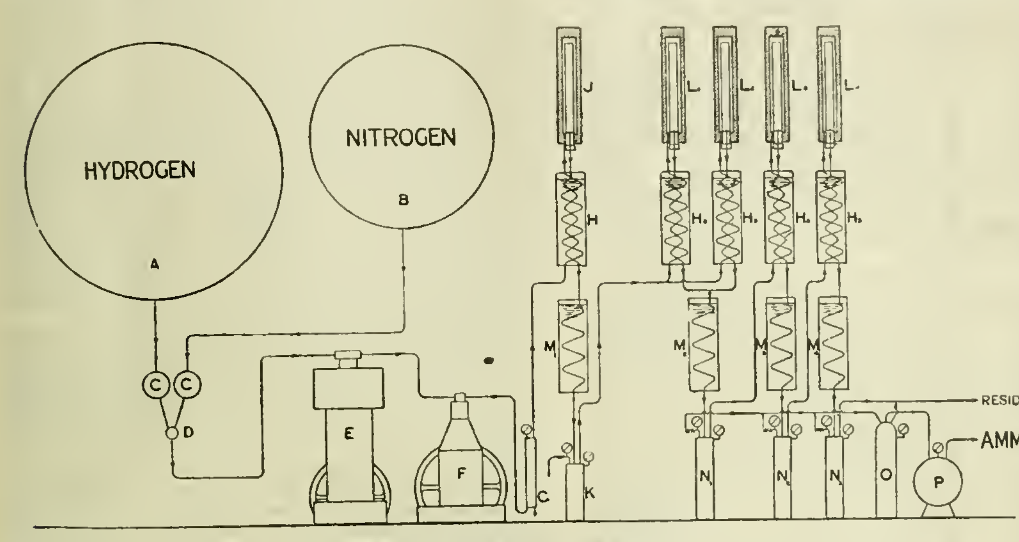
Now as to the actual construction of catalyst vessels to withstand the conditions of ammonia synthesis, that is to say a temperature of 600° C., a high pressure, and possible attack by the hydrogen. The Haber people first of all made an inner vessel of very pure iron and surrounded it with a layer of nitrogen under slightly higher pressure than that used inside, thus hoping to protect the outer vessel from the action of the gases. This was not a success, and they now use an outer vessel of high-tensile steel, probably tungsten steel, and protect it with a lining of pure iron. Since this lining is permeable to hydrogen, the outer vessel is perforated all over with small holes, so that any hydrogen passing through the lining can escape and not set up a pressure between the lining and outer vessel.

With the small Claude tubes it is possible to do away with all lining, and use a special nickel-chromium alloy. Some of Claude's tubes have been made by a French firm of steel makers, and some by Messrs. Vickers, of Sheffield, who had independently worked out alloys of this type. Messrs. Vickers' metal is known as "Vicronic," and it has very remarkable heat-resisting properties.

The tubes are cast solid and bored out. The head or plug is secured to the tube by an interrupted thread exactly like the breech mechanism of a gun, thus enabling the joint to be made very rapidly. The joint is made by a thin copper washer. The screwing up is done by means of a wormwheel attached to the head, rotated by two worms geared to a crank handle. The inner tube of thin sheet iron, which contains the catalyst material, is attached to the head, and it is quite easy to remove an inner tube and replace it by another containing fresh catalyst material in 7 or 8 minutes. Compare this with the time which would be required to unbolt the huge end plate of the Haber vessel, replace the catalyst, re-make the big joint, and screw up again.

Passing now to the catalyst material itself, it is not at all difficult to find a large number of substances which will give a good activity for a short time if pure gases are used, but it is quite another matter to find a catalyst which will have a long active life under works conditions and with gases which are only technically pure. In this M. Claude has succeeded admirably, and he uses a material which is made from very cheap substances by a simple process. The basis of his catalyst material is peroxidised iron prepared by burning iron in oxygen, with the addition of other equally cheap materials which are added in order to increase its activity and its immunity from poisons. The oxide of iron is, of course, reduced by hydrogen in the catalyst tube. Other catalysts may perhaps be more effective scientifically than Claude's, but their use necessitates the most elaborate precautions in removing the last traces of impurity from the gases. Now one of the most deadly catalyst poisons which is liable to be present in hydrogen obtained from coke-oven gas or water-gas is carbon monoxide. Claude often uses hydrogen containing 2 or 3 per cent. of carbon monoxide, and this is made possible by an extremely simple device. A tube, similar to the catalyst tubes, is traversed by the gases on their way from the super-compressor to the catalyst tubes proper. This "protector" tube, as it is called, is filled with spent catalyst material which has become insufficiently active for further use in the catalyst tubes, and is heated to about 400° C. Any carbon monoxide present in the gases is converted into methane, $CO+3H_2 \rightarrow CH_4+H_2O$. Any oxygen present is at the same time burned to water. Obviously, in industrial working the percentage of carbon monoxide must be kept as low as possible, or a serious loss of hydrogen would occur; but it is quite easy to do this.

The robust nature and fool-proof quality of Claude's catalyst material are features which greatly impress visitors to his plant, particularly those who have already seen the Haber plants and who therefore realise the elaborate precautions which have to be taken, and the unceasing scientific control which is required to keep the Haber catalyst in working order.



CLAUDE SYNTHETIC AMMONIA PLANT

DIAGRAMMATIC ARRANGEMENT

Fig. 5.

The next question is how to remove from the system the ammonia formed in the catalyst tubes. Here again the use of superpressures results in striking advantages. On cooling the gases containing ammonia to ordinary temperature, a certain proportion of the ammonia liquefies and may be separated by gravity from the gas, this proportion depending upon the ratio of the vapour pressure of ammonia to the total pressure of the gases. Under the Haber conditions with 200 atmospheres the Germans find it necessary to inject water into the system and thereby recover the ammonia as an aqueous solution. This all consumes a good deal of power and involves no little complication of plant, and if the ammonia is required in the anhydrous state the liquor has to be distilled.

At 900 atmospheres, however, simple cooling by a coil immersed in water suffices to liquefy the whole of the ammonia save 2 or 3 per cent., and this small quantity is easily removed from the residual gases either by further cooling produced by the vaporisation of part of the ammonia, or by absorption in sulphuric acid.

The uncombined or residual gases from the last catalyst tube, after removal of this ammonia, are returned to the system.

Fig. 5 shows the general arrangement of the plant. A and B are the hydrogen and nitrogen gasholders respectively, with meters, C, on the delivery pipes. The gases are mixed at the valve, D, and pass to the compressor, E, where they are compressed to 100 atmospheres. After going through an oil and water separator (not shown) the mixed gas is compressed to 900 atmospheres in the "supercompressor," F. Another oil and water separator, G, follows, and then the gas goes, *viâ* a heat interchanger, H_1, to the protector tube, J. Any water formed from traces of carbon monoxide or oxygen present in the gas is condensed in the cooler, M_1, and separated in the small separator, K. The pure gases next pass through the heat interchangers, H_2 and H_3, and the first two catalyst tubes, L_1 and L_2, in parallel, returning through the heat interchangers and the cooler, M_2, to the separator, N_1, where the liquid ammonia formed is withdrawn. The uncombined gas then continues through heat interchanger H_4 to the third catalyst tube, L_3, back through cooler M_3 to separator N_2, and the gas still uncombined goes to the last catalyst tube, L_4, and back to separator N_3 as before. The ammonia from the separators is blown into the collecting bottle, O, and from there to the storage cylinder, P.

This completes the description of the Claude plant and process for making synthetic ammonia, and demonstrates it to be a remarkably simple, straightforward, and fool-proof way of attaining the desired result, and in fact a most striking contrast to the complicated and intricate Haber method.

The raw materials (hydrogen and nitrogen), and the power requirements of the process may next be considered. Nitrogen can be made in standard liquid-air machines at a cost of a few pence per thousand cubic feet, and since there is only one volume of nitrogen to three volumes of hydrogen, the cost of it is not an important item. There are other methods of preparing pure nitrogen which will be dealt with later.

Hydrogen, however, is a big item in the cost, and cheap hydrogen is essential to the commercial success of synthetic ammonia. In this country, and at the present time, probably the most economical source of hydrogen is existing coke ovens. I say "existing" advisedly, because it would be another story if coke ovens had to be built at to-day's prices and a market found for the resulting coke.

The process adopted for separating the hydrogen from the coke-oven gas is a simple one of liquefaction in a modified form of liquid-air plant. The principle is fractional liquefaction, and not fractional distillation as in the liquid-air process. The coke-oven gas, after stripping in an ordinary by-product plant, is compressed to 25 atmospheres and passed through a tower containing water which dissolves most of the carbon dioxide, the last traces being removed by lime-water injected at the top of the tower. Were the carbon dioxide not removed, it would solidify and choke up the liquefaction apparatus. The compressed gas is then progressively cooled, the ethylene and similar hydrocarbons first liquefying, then the methane, after that the carbon monoxide, and finally the nitrogen, leaving only the hydrogen in the gaseous state. The nitrogen is liquefied at the top of the apparatus, and running down washes away the last traces of carbon monoxide which dissolve in it. The issuing hydrogen is allowed to expand while doing external work in an engine, and it is thereby cooled to about −210° to −215° C., and subsequently absorbs heat from the incoming coke-oven gas in a heat interchanger. The question of lubricating the cylinders of the expansion engine on this plant provided a nice problem. Petroleum ether makes a good lubricating oil for low temperature work, freezing only at −90° C., but this task was beyond it. Claude found a simple solution of the difficulty by mixing with the hydrogen a little nitrogen (the presence of which is of course quite harmless), whereby some of the nitrogen liquefies in the cylinders and forms an excellent lubricant. The manufacturing cost of hydrogen separated from coke-oven gas in this way is about 1s. 6d. per 1000 cub. ft. The remaining gases can be burnt in gas engines to produce power, and if the air admitted is reduced to a minimum the exhaust gases after removal of water and carbon dioxide are nearly pure nitrogen, thus providing another source for this material.

In countries where cheap water power is available, electrolytic hydrogen becomes very attractive.

The following table shows the comparative power requirements and cost of power per ton of ammonia as between hydrogen obtained from coke-oven gas with steam power at ½d. per unit, and electrolytic hydrogen with hydro-electric power at 1/25d. per unit:—

	Hydrogen from coke-oven gas. Steam power at ½d. per kw.-hr.		Electrolytic hydrogen. Hydro-electric power at 1-25d. per kw.-hr.	
	kw.-hr.	%	kw.-hr.	%
Nitrogen	279	8·53	279	1·79
Hydrogen ..	1,287	39·35	13,590	87·27
Compression ..	1,530	46·78	1,530	9·82
Miscellaneous ..	175	5·34	175	1·12
Total ..	3,271	100·00	15,574	100·00
	Cost £6 16s. 3d.		Cost £2 11s. 11d.	

In order to obtain the advantage of the cheapest available source of power, the Cumberland Coal, Power and Chemical Co. has acquired a controlling interest in the Tysse water-power undertaking in Norway. This great power-station contains plant for producing 145,000 electrical horse-power, current being generated at 12,000 volts, 3 phase, 25 cycles. Including the actual running expenses of the power-station, upkeep, and depreciation on the purchase price, one horse-power will cost at Tysse £1, or less than 1/25 of a penny per kilowatt-hour. By securing the control of this undertaking, the company also acquires the extensive factories situated at Odde, about 4 miles from Tysse. These works, besides containing large manufacturing buildings, are well-equipped with workshops, foundries, stores, laboratories, and shipping facilities. At Odde, 100,000 electrical horse-power, transmitted from Tysse, is immediately available.

It is intended in the near future to erect a Claude plant to produce 156,000 metric tons of ammonium sulphate annually. Another works, with an initial output of 50,000 t. per annum of ammonium sulphate, is to be built near Workingham, in Cumberland, adjacent to an existing coke-oven plant, the production being intended for home consumption.

THE LIBRARY OF THE CHEMICAL SOCIETY.

F. W. CLIFFORD.

For some time past the Library of the Chemical Society has been much used for purposes of research in connexion with technical subjects, but from inquiries which are received from time to time it is obvious that there are still many members of the kindred societies who are unaware of the character and scope of the collection, and of the facilities available to those who may not be Fellows of the Chemical Society. This is not altogether to be wondered at, as neither the size of the Library nor its value can be estimated by a brief visit to the Reading Room, where only about one quarter of the books can be exhibited. Were the collection properly housed in a building capable of showing the volumes in their entirety, it would be at once apparent that the Library is a possession of which the Chemical Society may well be proud.

At the present time the Library contains 26,000 volumes and is increasing at the rate of 800 volumes per annum, the annual cost approximating to £1500. The Reading Room is situated on the second-floor of the building, and contains about 7000 volumes which can be referred to by the reader without formal application. The volumes thus displayed include the standard reference books, a large proportion of the systematic works, and certain periodicals in frequent use. The remaining 19,000 volumes are housed in various parts of the building and can be obtained on verbal application. Some 12,000 volumes are shelved in the basement in Lucy's Rolling Stacks. These stacks are an ingenious device, intended to shelve the largest number of books in the smallest possible area, and in consequence do not lend themselves to the display of their contents, but no other system was possible owing to the lack of space. Whilst so large a proportion of the books is distributed throughout the Society's rooms, their location can be readily ascertained by reference to the card catalogue, and in this connexion it is of interest to note that card indexing was in use at the Chemical Society as far back as 1870.

Readers visiting the Library for the first time are advised to consult the staff as to the general arrangements, and it should be remembered that as books can be borrowed, volumes on the shelves may only represent a proportion of the books on any given subject, and the one required may be for the moment out of the Library.

The policy of the Council towards the Library has always been generous, and it has thus been possible for the Library Committee to take a broad view in regard to the purchasing of books. It has been the custom to acquire all those dealing with the scientific aspect of chemistry which were of any real value and importance, and books on applied or technical chemistry when these dealt with the chemistry of the processes involved. Those confronted with problems lying on the border-lines between chemistry and other sciences will also find that their needs have been largely anticipated. It is to be hoped that the present financial stringency may not lead to a limitation of these ideals.

In 1917, consequent on an increasing demand for books on applied chemistry, the Council decided to proceed immediately with the extension of the Society's Library in a more technical direction, and called a conference to discuss the possibility of co-operation. Reference to the resulting scheme appeared in the *Journal of the Society of Chemical Industry* (38, 1919, 8, 77, 447 R). Under this arrangement members of the Society of Chemical Industry, in common with those of the other contributing societies, have the same privileges with regard to the use of the Library for consultation and loan purposes as Fellows of the Chemical Society. During the past two years the Association of British Chemical Manufacturers has aided this scheme by very generous grants, and this material assistance has contributed largely towards its success.

It is not possible in this article to give a complete list of all the subjects represented in the Library, but it will be of interest to technologists to learn that the section relating to dyes contains 140 items, that of metallurgy 120, agriculture 206, and oils, paints, etc., 127. The comprehensive character of the Library has sometimes been tested by challenging visitors to name some subject into which chemistry does not enter, and regarding which some book in the library does not supply information. So far, the challenge has been upheld, even a feminine request for information relating to furs having been met by the production of Solaro's "Studio microscopico e chimico pel ricononoscimento" with its excellent photomicrographs of fur and hair of all kinds. The purchases during a recent month well illustrate the wide field of chemistry, including, as they do, books on laboratory planning, textiles, foods, plant products, paper, varnishes, colloids, refrigeration, synthetic ammonia, yeasts, and economic mineralogy.

In order that new books may be promptly brought to the consideration of the Committee, and the up-to-date character of the Library thus be maintained, the following journals relating to the book trade are purchased for the use of the Librarian:—*Bookseller; Publishers' Circular; Times Literary Supplement; Publishers' Weekly* (American); *Bibliographie de la France; Wöchentliches Verzeichnis.* It is surprising that no single periodical supplies a complete list of the books published in the United Kingdom, and an authoritative publication of this nature is badly wanted. In preparing the agenda of the Library Committee, all works of chemical or allied interest mentioned in these journals are noted, and after a preliminary sifting a list is compiled and sent to the members of the Committee. The individual member is not required to express an opinion upon the whole of the books mentioned, but his particular attention is drawn to those dealing with any subject of which he has special knowledge, and he is asked to report upon the question of their acquisition. The advice of referees other than members of the Committee is sought when needed. By means of this system the collection has been gradually built up on a recognised plan, with the result that the various sections are particularly well-balanced. The advantages of the systematic purchase of books by the Chemical Society, irrespective of the demand, need not be impressed upon the technical chemist, many of whom during the years of the war found important foreign books in the Library for which they had vainly searched elsewhere.

The chief value of a Library of this kind is, however, in its periodicals. By the time that technical processes are described in books they are often obsolete or of common knowlege. Further, the writers of such books frequently have insufficient practical experience, or it is obvious that they are not permitted to include all that they would wish. Inquirers who sometimes ask for a book containing minute details of some recent technical process, and are confident that there must be a book written on the subject, might with advantage remember the remark of the editor of a financial paper, who, when asked by a correspondent for a list of low-priced shares certain to rise in the immediate future, replied, "The member of our staff who answered this type of inquiry has recently commenced business as a millionaire on his own account."

Whilst the type of book already mentioned may serve to indicate the direction of research, the investigator is compelled to search through periodical and patent literature in order that he may glean, here and there, information which his specialised knowledge may enable him to turn to account.

A comparison of the list of 270 current journals contained in the Library with that of the journals abstracted by the Society of Chemical Industry, shows that 148 of the latter are contained in the Library, and of these several are duplicated for loan purposes. In order that journals should be accessible at the earliest possible moment, they are supplied by post as published.

Considerable trouble and expense was incurred during the war to maintain the supply of enemy publications. Whilst this was originally done for reasons which may be obvious, it has proved of unexpected advantage, as in several instances limited editions were printed, and those who now desire to complete their sets often find that numbers are out of print.

Many interesting volumes relating to alchemy and early chemistry are contained in the Library, including some presented by Faraday, and a collection of rare and valuable works, the gift of the late Sir Henry Roscoe. It is noteworthy that whereas the cloth bindings of Faraday's books are sound and apparently good for many years yet, the leather bindings have suffered extreme decay. Chemists who for reasons of economy are now reluctantly compelled to adopt cloth or buckram bindings for their books, may find some consolation in this fact.

It must not be thought that the historical sections are without interest to the technologist. The manufacturer of food products may learn from Simpson's "Zymologia physica, or a brief philosophical discourse of fermentation," London 1675, that at that early date the author was acquainted with the preservation of fruit in airtight receptacles, and records that "in January I have had tarts made of them (damsons, etc.) to entertain Strangers with." It is impossible that Agricola's "De re metallica," with its wealth of detailed illustrations, could fail to fascinate the metallurgist, and the chemical engineer might be amazed to find in the same work, among many other mechanical contrivances, an illustration of a bucket elevator, complete with "hooked link"! Porta's "De distillatione" and French's "Art of distillation" are among the early books which would interest the distiller. The manufacturer of insecticides and fruit sprays might find recreation in a perusal of "De Venenis; or, a discourse of poysons," written by William Ramesey in 1663, who includes among poisons "the malicious beams of a malignant eye" and "the breath of a cat." This quaint volume possesses two prefaces, one addressed "To the judicious and ingenious reader" and another "To the more imprudent and rurall reader." In the latter class are included "Confident Youngsters and Women, who think their own witts best." Yet this 17th-century physician in his "epistle dedicatory" advises original research, and states that "none will or can deny Chymistry to be of great use in the practice of Physick."

Among other rare volumes the following may be specially mentioned:—A copy of the 1628 edition of Gilbert's "De Magnete"; a series of the writings and books of Robert Boyle, consisting of 65 items; an "unknown" edition of Basil Valentine's "Triumphal Chariot of Antimony," bearing an earlier date than that hitherto considered to be the first edition; and a unique volume presented on the occasion of the Jubilee meeting in 1891 by the late Mr. R. W. Warrington, the eldest son of the first Secretary. The last-mentioned volume is a handsomely bound collection of the original letters and papers relating to the foundation of the Chemical Society, to which have been added platinotype copies of portraits of the original members. It is not generally known that these photographic reproductions are mainly the work of the present chairman of the Library Committee, Prof. J. M. Thomson, who was then one of the Honorary Secretaries. Before leaving the subject of old books, it should be mentioned that the Committee is anxious to obtain a copy of, at least, every work printed in English on chemical subjects to the end of the 18th century (*cf.* Presidential Address, 1902), and if any reader of this article cares to present any volume not already in the Library, it would be gladly received. Such volumes often have but little monetary value, but the writer can bear witness to the frequency with which old and apparently valueless books have been sought for, in order to elucidate some historical or legal point at issue. Many volumes published prior to the Copyright Act are not to be found in the national collections, and it is but reasonable that inquirers should expect to find them at the Library especially devoted to chemistry.

With some exceptions the books may be borrowed under suitable regulations, and may be sent by post, the borrower paying cost of carriage.

As early as 1879, in order that the reference character of the Library should not be impaired, some of the more important chemical serials were duplicated for circulating purposes, and these sets have been added to from time to time. The late Sir Henry Roscoe fully realised that the loan of journals was a great aid to research, and anticipating a greater demand for them, he presented in 1907 several valuable serials in order that a second copy might be available for loan. The Library is not so rich in duplicate technical journals as could be desired, and the contributory scheme of co-operation does not provide for the purchase of back volumes. If any member of the Society of Chemical Industry wishes to render a distinct service to chemical industry in this country, he cannot do better than follow the generous example of the former President of that Society.

NEWS FROM THE SECTIONS.

MONTREAL.

The opening meeting of the new session was held at the Queen's Hotel, Montreal, on October 28. Mr. H. W. Matheson, chairman of the Section, presided, and 46 members and guests were present.

Mr. Matheson, in a short address, referred to the Annual Meeting held in Montreal in August. He spoke of the good results which should follow the intimate association of the members from both sides of the Atlantic, and thanked the members of the Special Committee on Arrangements, and those who assisted them, for the energy and enthusiasm with which they had performed their tasks. In a few words he pointed out some of the advantages of membership in the Society, and appealed to the individual members of the Section to assist the Membership Committee to the fullest extent in procuring new members. In discussing the proposal to form an organisation to act as a council for Canada to deal with purely Canadian affairs, he explained that the idea was that each Section should appoint representatives, who should be members of the Section, and that in this way, without recourse to London, the Council would be able to present a solid front on any questions, *e.g.*, those dealing with legislation, in which they might wish to use their influence. The organisation of this matter is in the hands of Mr. T. H. Wardleworth.

After the treasurer had reported that the finances of the Section were in excellent order, Mr. McIntyre, chairman of the Special Committee on Constitution and By-laws, placed the proposed by-laws before the meeting; these were passed, and the hon. secretary was instructed to send a certified copy to London for approval. Mr. Matheson explained the proposal to form a section of the Chemical Engineering Group, and invited any interested members to apply to the secretary for a copy of the "Proceedings," on approval. Six of those present took advantage of this invitation. Mr. Woodland, chairman of the Programme Committee, presented the list of fixtures for the season 1921–22, and the chairman thanked him for the excellent arrangements that had been made.

The meeting was preceded by a dinner, to which ladies were invited, and musical items were given at intervals during the evening.

BRISTOL AND SOUTH WALES.

A meeting was held at University College, Cardiff, on November 4, Prof. C. M. Thompson presiding. In a paper on "The Development of the Gas Industry," Mr. H. Canning described the early types of cast-iron retorts and the introduction of fireclay retorts. With reference to the development of regenerative firing and continuous-feed retorts, it was noted that certain coals were best suited for particular types of retorts. The enrichment of coal gas by oil gas and carburetted water gas was described in some detail, together with the methods of removing tar, ammonia, hydrogen sulphide, etc. The Burkheiser process introduced at Bournemouth was criticised; and lastly the enormous development of the industry was described.

GLASGOW.

The third meeting of the session was held on November 14 in the Institute of Engineers and Shipbuilders, Glasgow. Mr. J. H. Young was in the chair, and Mr. E. H. Lewis, of the Glasgow Iron and Steel Co., Ltd., read a paper on "Iron Portland Cement."

Mr. Lewis began his paper with a short account of the nature and manufacture of ordinary Portland cement, and mentioned certain Belgian cements, the ingredients for which occur in nature in the required proportions. The name "Iron Portland Cement," the speaker explained, was a literal translation of the German "Eisen-Portland-Zement." He described its manufacture in the steelworks and showed samples of the ingredients and of the product in the various stages. Figures were given indicating that granulated slag was in itself a cement, briquettes of that material showing a more or less steady increase in strength over periods as long as four years; and other data adduced showed the increase in strength of cement when ground blast-furnace slag is added to it. The results of tests of various mixtures of slag and clinker were given, and mention was made of the prejudice of engineers on the subject of the sulphur-content of the material, although no failure of any structure had been traced to that source. The importance of tri-calcium aluminate, in which the slag was rich, was that it acted as a kind of flux and activator for di-calcium silicate, colloidal silica being liberated in very thin layers between the particles of inert materials.

Mr. Lewis cited a case demonstrating the injurious effects of free lime and magnesia in cements, the increase in volume from hydration and carbonation causing the structure to crack. Magnesia, he said, was more objectionable than lime since it acted more slowly, but the blame for failure in concrete structures should not be put on the cement without careful investigation, as the fault frequently lay with the aggregate.

The speaker drew attention to the controversy between manufacturers of ordinary Portland cement, and manufacturers of Iron Portland cement, and expressed the opinion that the latter product had proved certainty of equal, and in certain cases, of greater value. A notable example was its superior resistance to sea-water.

THE CHEMICAL INDUSTRY CLUB.

The third annual dinner was held in the Connaught Rooms, London, W.C., on November 18, Mr. A. Chaston Chapman presiding.

After the toasts of the King and the Prince of Wales had been honoured, Mr. J. Hunter Gray, K.C., proposing "The Profession and Industry of British Chemisty," said that although his knowledge of chemical subjects was elementary, yet it was sufficient to convince him that the high efficiency of the British chemical industry had led to the successful termination of the war. The public had to some extent realised the importance of chemistry during the war, but had forgotten it already. Germany had prepared for 20 years to enter the field fully-equipped chemically, and it was a great credit to British scientists that when peace dawned they had not only equalled but had excelled the Germans in the production of munitions of war. The Government was even more to blame than the public for our state of unpreparedness in the early days of the war, and unless the scientific organisations stood together in the future, the prosperity of the Empire would be endangered. As a humble observer he could only believe that the first country to become supreme in science would be predominant, and it would be a disgrace if this country lost the high standing attained by the efforts of its scientific men. There was no nation which depended more on its industries for national welfare than Great Britain, and unless the public was compelled to ensurè the prosperity of science, both pure and applied, our industries would deteriorate. The road to national prosperity lay in the formation of powerful scientific organisations, and it behoved all present to join hands in united effort to further that end.

Mr. Max Muspratt responded and said that although Mr. Gray's experience in chemical matters might be small, he had ably interpreted the attitude of the hard-thinking public towards the chemical industry before and during the war, and what was expected of it in the future. It was his belief that the chemical industry was suffering from a bad attack of excessive modesty; but that the chemist was awakening to the realisation of his true position was manifest in the rapid growth of the Chemical Industry Club. It was to be deplored that the Government had held such a narrow view of the importance of chemistry and thus risked the life of the nation in its time of trial, and he suggested that had there been competent selection and wholesale recruiting of trained chemists in the early days of the war, the armistice would have been signed two years before it was. Some of the methods employed by the Government during the great national crisis had been appalling, and it was the duty of all present to obviate the possible recurrence of past blunders. To achieve that end it was obvious that the great scientific organisations required intercourse, and as a medium for such intercourse he could conceive of nothing more expedient than the Chemical Industry Club. He emphasised the importance of the part played by chemical manufacturers during the war, and said that although their position at present was none too covetable, there were signs that prosperity was returning, but its permanence would depend entirely upon the efforts of chemists as a whole. He had great confidence in them as Britishers, and if they pulled together in the future, as they had learned to do in the past, nothing could impair the attainment of great prosperity in the chemical profession and industry of the Empire.

"The Chemical Industry Club" was proposed by Mr. H. J. Johnson, Master of the Worshipful Company of Tallow Chandlers, who laid stress on the importance of the Club as a medium for the interchange of ideas and opinions among industrial, technical, and academic chemists. There was no limit to the benefits that could be derived from the advantages and amenities of social intercourse, and although the Club comprised but a small proportion of those who practised chemistry, those present were truly representative of the great science in all its branches. He then indicated the usefulness of the City Guilds to industries with which they were connected: they had done much to further technical education, and chemistry was receiving their support.

Replying to the toast, Mr. A. G. Craig said that the policy of the Club must be to benefit chemical industry by strengthening the profession of chemistry. The membership of the Club was now about 700, but unfortunately that figure represented only a very small fraction of the members of the different chemical societies. He made an earnest appeal to all connected with chemistry and chemical industry to join the Club.

The toast of "The Visitors," proposed by Mr. F E. Hamer, was replied to by Dr. S. Miall and Dr. J. H. Paterson; and Dr. W. R. Ormandy gave the toast of "The Chairman."

In response, Mr. Chaston Chapman emphasised the usefulness of the Club in filling what was once a hard-felt want; there was previously no place where chemists could meet and discuss matters of commonplace and technical interest, and the fact that the Club was already a large organisation revealed that the importance of chemistry was becoming increasingly recognised. When one considered the indispensability of chemistry to national security it was disgraceful that there was no house where the numerous branches of the science could be represented as a whole. He was convinced that the scheme for establishing a chemical home would materialise. In that connexion the Club should play an important part; and he looked forward to the time when chemistry would receive from every educated member of the public that recognition, support and esteem so essential to the maintenance of the country's position.

Exchange of Greetings with the Chemists' Club of New York.

The following letters have recently passed between the Chemical Industry Club and the Chemists' Club of New York. The first message was presented personally to the New York Club by Mr. C. J. Goodwin on the occasion of the visit of the Society of Chemical Industry.

To the Chemists' Club, New York.

"The chairman and the committee of the Chemical Industry Club, London, desire on behalf of the members, on the occasion of the visit to the United States of representatives of the Society of Chemical Industry, to send their very cordial greetings to their colleagues of the Chemists' Club of New York.

"Both institutions are united in a desire to cultivate and provide for the social side of chemical industry and chemical science, and by opening their doors to visiting members of either club have already done something and may yet do more to promote the acquaintance and consolidate the friendship of the chemists of both nations.

"At the present moment the greetings we send through Mr. Goodwin have more than a purely personal and domestic interest. They are an indication of the sincere desire on this side for increasing friendship and good understanding between Great Britain and the United States, as a guarantee not only of the progress of the two great English-speaking nations, but of the peace and well-being of the world.

"This visit takes place at a time when all the influences that make for international friendship need to be cultivated, and among the most stable bonds of unity is the common service of mankind through scientific research and the application of its results to industry. On this basis the scientists, and especially the chemists, of your nation and ours may find common ground in their sympathies, aims and work. Both can gain nothing but good for a better acquaintance and closer association with each other, and in sending these words we desire you to accept them, not merely as a courtesy, but as representing our sincere desire for ever-increasing friendship and co-operation between Great Britain and the United States."

To Mr. H. E. Coley, Hon. Secretary of the Chemical Industry Club.

"Your letter of August 10 was duly conveyed to the Chemists' Club through the kind offices of Mr. C. J. Goodwin, but as the period was not one when the message could be delivered to the members of the Club, or at least the trustees, it had to take place at a joint meeting where several of the members of the Society of Chemical Industry of both London and New York were present, the writer being delegated to accept, on behalf of the Club, the very kind and courteous letter which the members of the London Club had through you sent to us.

"It is needless for me to say that letters of this sort passing between the various countries where English is spoken can only do good and can never do harm, more especially when they are knitted together in one common cause; that is, the uplifting and the spreading of science throughout the English-speaking races.

"Another point, which perhaps is hardly to be mentioned, in connexion with this is the enormous political influence that such associations may have. Although there may be many occasions when one hears adverse criticism, those who do not know the American public as well as the writer will hardly realise the position as he sees it. Every American thinks it his bounden duty to criticise everything he sees and hears, whether it be his own brother, his own father or his own mother, or his college chum, or anything outside of the country; but he criticises always, I think, without exception, in a friendly way, never doing it with that nasty spirit which we have been so frequently confronted with by some of the European nations—we need not mention any names—but living here among them as I do, I find the criticism is always friendly, and it is my pleasure to pass to you the friendly feeling which the whole of the Chemists' Club feels toward the Chemical Industry Club. You may rely upon the trustees and the management in general doing all they can to assist anyone who should come recommended by the Chemical Industry Club, not only as it has been done in the past, but it is hoped that a greater bond will be cemented in the future by the friendship which has already been started mostly by the help of Mr. Coley in the kind way which he has sent visitors to us with all sorts of good words.

"On behalf of the trustees and officials of the Chemists' Club I have again to thank you for your kind greetings, and also to thank Mr. C. J. Goodwin, who so kindly conveyed by word of mouth the feelings that have existed between the two Clubs and which he hoped and we also hope will exist for many years to come."

T. R. Duggan,
Oct. 15, 1921. *Trustee.*

THE PROPOSED INSTITUTION OF CHEMICAL ENGINEERS.

Probably the dominant feeling of those who attended the informal dinner and meeting held on November 9 at the Engineers' Club, London, to discuss the formation of an Institution of Chemical Engineers, was one of regret that the proposal involved the addition of yet another society to the already overburdened list; but to allay anxiety on this head, Sir Arthur Duckham, who presided, admitted the criticism and suggested that a disease could sometimes be cured more readily by previously aggravating it. He also suggested that the real chemical engineer did not as yet exist—there were only engineers who knew some chemistry and chemists who had some knowledge of engineering—and the object of the proposed institution was to foster the creation or evolution of a new species of technologist and to safeguard its interests when established. The proposal had received support from all parts of the country.

The theme was pursued by Prof. J. W. Hinchley, the organiser of the meeting, who expressed his conviction that such an institution was bound to come; the only question was whether the present time was the right one. He dwelt on the pre-eminence of German chemical engineering and related some of his experiences showing how in this country enormously increased efficiency had been attained in certain chemical manufactories where the design, construction and control of plant had been placed in the hands of really qualified men. The functions of the proposed institution, he said, would not in any way clash with or overlap those of the Chemical Engineering Group, which was not a qualifying body, but a branch of the Society of Chemical industry, whose mission was to disseminate knowledge. The whole tendency of modern times was towards increased specialisation, and chemical engineering was essentially a specialised branch of knowledge arising from the application of engineering science to large-scale chemical manufacture; a man might be an excellent chemist and an excellent engineer, but he was not on that account a chemical engineer. Therefore it was desirable that some institution should be formed to take in hand the question of his education and qualifications, and this could be done without encroaching upon the preserves of any existing bodies.

Mr. W. J. U. Woolcock, in submitting that the formation of an Institution of Chemical Engineers was desirable, referred to the findings of the mission sent to Germany by the Association of British Chemical Manufacturers concerning the high efficiency of German chemical engineering and the lack of it in this country. The proposed institution would, he thought, be welcomed by the British Chemical Plant Manufacturers' Association, which he had helped to promote, and he could not see how it would conflict in any way with existing organisations. Education was the basis of any claim for special privileges, and the training of the chemical engineer must precede his claim for recognition. The speaker's resolution was carried unanimously, as were also the proposals to form forthwith a provisional institution and to elect a provisional committee with power to co-opt. The committee was then constituted of the chairman, Sir Arthur Duckham, and of those who had proposed and seconded the various resolutions, viz., Messrs. Woolcock, F. M. Rogers, F. A. Greene, D. Brownlie, J. A. Reavell, W. Macnab, H. Talbot, and J. MacGregor.

In the discussion Mr. C. J. Goodwin suggested that it might be advisable to consider the practicability of joining forces with the American Institute of Chemical Engineers in order to form one body for all the English-speaking peoples, or, alternatively, of working in close communion with the American society; and Mr. Macnab proposed that the provisional committee should discuss the possibility of amalgamating with some existing organisation. It appears, however, to be probable that an independent institution will be formed, not only because such a course would be in accord with the individualistic spirit of our race, but because it is recognised that the chemical engineer, being neither a true chemist nor a true engineer, cannot be adequately nurtured by either a purely chemical or a purely engineering body. Nature has made him a hybrid; nurture must develop in him a harmonious blend of the useful characters of his distinguished forbears.

MEETINGS OF OTHER SOCIETIES.

THE PHYSICAL SOCIETY.

Sir W. H. Bragg delivered his presidential address, entitled "The Structure of Organic Crystals," on November 11 at the Imperial College, S.W. Reference was made to the two principal methods hitherto employed for the X-ray analysis of crystal structure, viz., by using a single crystal, preferably about 1 mm. in linear dimensons, or the powdered substance. In the latter method accuracy has been considerably increased by employing a gas-filled X-ray bulb provided with an aluminium disc having a fine slit near the anti-cathode. Examination of the diamond by the X-ray method indicates that the atoms are packed together tetrahedrally. They are not, however, close-packed; in fact, the structure is comparatively loose, and there is sufficient unoccupied space to accommodate as many more atoms as the number actually present. The atoms in certain planes are grouped together so as to form a hexagonal figure. These planes, indeed the whole structure in the case of the diamond, are rigidly bound together. With graphite, however, the distance between the planes is somewhat greater, and the bonds uniting the planes are comparatively weak. A certain amount of sideways motion of any such plane relative to adjacent planes is therefore possible, thus explaining the laminar structure and lubricating property of graphite.

The structure of benzene has not yet been elucidated by the X-ray method, owing to the difficulty of obtaining it suitably crystallised, but that of naphthalene and similar compounds has been experimentally determined. The fundamental structure in the naphthalene series is shown in Fig. 1, where the carbon atoms in the elementary cell are represented by black dots. The several cells are braced together by the remaining element constituting the molecule. Considerations based upon the interpretation of the X-ray spectra yielded by crystals of naphthalene indicate that the dimensions of the respective sides of the cell are 8·34, 6·05, and 8·69 Ångstrom units (1Å.U.= 10^{-8}cm.). From the value of the density it is deduced that such an elementary cell contains two molecules of naphthalene. It will be readily seen from Fig. 1 that the carbon atoms, A, B, C, D, E, and F, form a hexagonal structure of the kind already referred to. Difficulties in interpreting the results obtained with aromatic substances are readily surmounted by assuming that this hexagonal structure or benzene ring of carbon atoms, as it may be termed, is an actual structure having definite size and form, and that it is built as a whole into the series of compounds.

Study of compounds of the naphthalene series has revealed two different types of elementary structure. In the one class the elementary cell resembles in general form, though not necessarily in linear dimensions, the structure shown in Fig. 1.

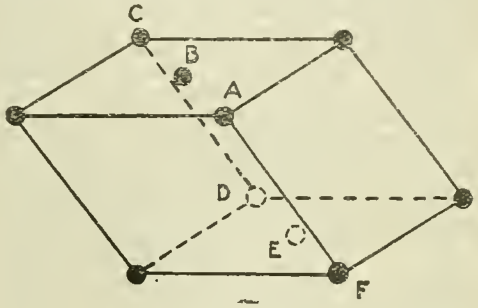


Fig. 1.

Such an elementary structure occurs in anthracene, with linear dimensions somewhat greater than those of naphthalene, and in α- and β-naphthol. In α-naphthol the elementary cell is considerably larger than in β-naphthol, the former containing four molecules and the latter only one. Substances such as acenaphthene, benzoic acid, and salicylic acid illustrate the second class of elementary cellular structure, which is rectangular, and contrasts with the oblique structure characterising the first class. The structural formula of acenaphthene gives no clue to the symmetrical nature of the elementary cell, which is readily shown by X-ray analysis. The elementary structure of this substance is to be regarded as built up from the oblique naphthalene structure shown by dotted lines in Fig. 2, in which the full lines denote a section of the acenaphthene cell, the naphthalene cells being built into the structures towards both the right and left hands. Similar considerations apply to the other members of this class.

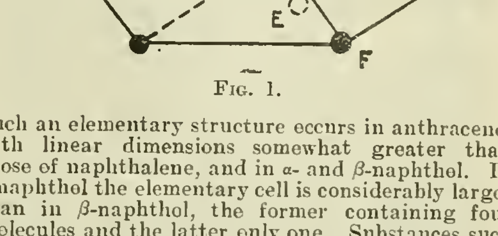


Fig. 2.

Seconding a vote of thanks to the lecturer, proposed by Dr. Charles Chree, Sir Robert Robertson emphasised the great importance of the subject to the organic chemist, and expressed the interest with which they looked forward to the elucidation by this method, of anomalies between the structural formulæ and the crystalline forms of organic substances, among which he instanced certain nitro-compounds having symmetrical structural formulæ but completely lacking in crystalline symmetry.

LA SOCIÉTÉ DE CHIMIE INDUSTRIELLE.

The first congress and exhibition of industrial chemistry were held from October 9 to 16 at the Conservatoire National des Arts et Métiers, Paris. A private reception was given by the Society at the Palais d'Orsay on October 9, and on October 10 M. Dior, Minister of Commerce, formally opened the congress in the large lecture theatre of the Conservatoire. The foreign guests included Sir William Pope, Mr. E. V. Evans, Mr. W. F. Reid, Prince Ginori Conti (president of the sister society in Italy), Dr. F. G. Cottrell, and delegates from Belgium, Luxembourg, and Greece. The president of the Society, Monsieur Paul Kestner, welcomed the visitors and said that their presence furnished proof of the desire to continue the collaboration of war time through times of peace. After describing the work done by the Society since its formation, M. Kestner outlined its future programme, appealed to the industry for assistance in research, and emphasised the need of more intimate relations between pure and applied chemistry. Such a close union could be brought about by the foundation of the Maison de la Chimie (*cf.* J., 1920, 39 R), which would be the prelude to an international alliance that would soon make itself felt. Sir W. Pope then delivered an address on "The Future of Organic Chemistry." M. Dior thanked Sir W. Pope for his address, and presented him with the first medal awarded by the Society.

In the afternoon the fifteen technical groups into which the congress was divided began their meetings, at which papers were read on a great variety of subjects, including analytical chemistry, apparatus and plant, fuels, metallurgy, heavy chemicals and electrochemistry, limes and cements, dyestuffs, pharmaceutical products, paper, leather, and the preservation of food. A special section discussed economic organisation, sources and markets, tariffs, legislation, and under the last-named head Mr. E. V. Evans read a paper on the British dyestuff industry (*cf.* J., 1921, 400 R).

Addresses on the nitrogen problem were delivered by MM. Matignon, Gall, and Claude. M. Matignon rapidly summarised the various methods of fixing nitrogen now in use and described the synthesis of nitric acid, calcium cyanamide, ammonia, and cyanides. M. Gall, of the Société d'Electrochimie et d'Electrométallurgie, in describing the manufacture of cyanamide, indicated the difficulties of obtaining the theoretical yield of 25 per cent., and discussed the advantages of cyanamide as a fertiliser. M. Georges Claude, in a paper on "Thoughts on Scientific Research: The Fixation of Nitrogen," showed the importance of the progress of science to national defence, and, commenting upon the poverty of French laboratories, invited financial aid from the industry. Acknowledgment was accorded to the work of M. Guillaume, the inventor of "Invar" (*cf.* J., 1917, 34; 1919, 821 A), and to M. Le Chatelier, for his work on analytical chemistry. M. Claude also discussed the Haber process and the part played by the "Badische" during the war, and outlined possible improvements in the synthesis of ammonia. Owing to the large number of people who could not gain admittance to hear M. Claude, the lecture was repeated to another crowded audience. At the closing session, presided over by M. Loucheur, Minister of the Liberated Territories, M. H. Le Chatelier gave a critical account of the present state of analytical chemistry. He observed that empiricism still prevailed in the teaching and methods of this important subject, and expressed the view that the subject should be taught, not by detailed description of methods, but by demonstrating the basic experimental data and the numerical laws relating to solubility, supersaturation, etc. In describing analytical methods due consideration should be given to the conditions under which they are carried out and to the scientific justification of the directions prescribed. It was desirable to standardise methods of analysis, or at least their principles, and an indication of the time required to carry out a determination would enable the practical value of the method to be judged.

More than 200 members and guests attended the banquet held in the Palais d'Orsay, M. Lefebvre du Prey, Minister of Agriculture, presiding. M. Kestner thanked those who had come from near and afar to make the meeting a success, and read a cablegram from Dr. W. H. Nichols conveying the congratulations of the American Chemical Society. Sir William Pope tendered thanks on behalf of the foreign guests, and Prince Ginori Conti expressed the hope that members of the Society would be able to attend a meeting and reception to be held shortly in Italy. M. Lefebvre du Prey proposed the toast of the Society, and announced that the Institut de Recherches Scientifiques of the Ministry of Agriculture was now about to start work.

Two days were devoted to visits to works. On October 12 a large party visited the porcelain factory at Sèvres, and the works of the Société d'Eclairage, Chauffage et Force Motrice at Gennevilliers, and on the following day an excursion was made to the works of the St. Gobain company at Chauny (*cf.* J., 1919, 223 R), and to the garden city of Tergnier.

The exhibition organised by the Society attracted many visitors. A series of lectures was arranged to show the value of the kinematograph to industry as a means of instruction, recording, and making propaganda. Films were shown illustrating the manufacture of glass, special steels, cement, paper, and the extraction of potash in Alsace.

THE CERAMIC SOCIETY.

"Closed-Circuit Grinding" was the subject of a paper read by Mr. J. C. Farrant before the monthly meeting held on the 7th inst.

Continuous, closed-circuit wet grinding has superseded batch-grinding in the preparation of paints, and of silica, phosphates, felspar, etc., for use in various industries, and it is suggested that it would be equally suitable for grinding pottery materials. The advantages claimed for such a system include greater tonnage per horse-power, reduced labour costs, continuous operation, and lower consumption of grinding media.

The apparatus consists of a Hardinge mill and a classifier, the former being a conical grinding vessel (instead of a cylinder), using flint pebbles as grinders, and flint lining, or in some cases steel balls and steel lining. The classifier is a rectangular tank containing mechanically-operated rakes; it is deeper at one end than at the other, and at the deeper end a settling pool is formed, into which the partially ground material from the mill is discharged. The fines are washed up, and the coarse material which settles is automatically returned to the grinding mill. The material cannot get out of the closed circuit until it has been ground fine enough to be washed up at a pre-determined fineness. In open-circuit grinding the material passes directly through the grinding mill, and none of it is returned for regrinding.

Owing to the conical shape of the mill a positive classification of the grinding media takes place, resulting from the different speeds at which different parts of the mill revolve. The large balls or pebbles remain in the cylindrical (broader) portion of the mill, and the smaller ones take up positions nearer the narrow discharge-end. Thus, large pebbles act on the incoming coarse feed, and as the material becomes broken up it travels towards the discharge-end, where the small balls or pebbles grind it further. The grading of the finished product can be regulated by varying (1) the initial feed to the mill, (2) the speed of the grinding mill, (3) the amount of dilution with water when grinding, and (4) the size of grinding media. In two-stage grinding some of the oversize particles produced by the first mill are ground in one or more secondary mills. A combination of three 8 ft. Hardinge mills and eight classifiers can grind continuously 30 tons per hour to a size of grain which will pass a 200 lawn sieve (0·063 mm.).

THE CHEMICAL SOCIETY.

The following papers were presented to the meeting held on November 17, Sir James Walker presiding:—I. "The Influence of Nitro-groups on the Reactivity of Substituents in the Benzene Nucleus": Part V. Hetero-nucleal Dinitro-derivatives: H. Burton and J. Kenner. II., "Organo-derivatives of Bismuth, Part V.: The Stability of Halogen, Cyano-, and Thiocyano-derivatives of Tertiary Aromatic Bismuthines": F. Challenger and J. F. Wilkinson. III. "Organo-derivatives of Bismuth, Part VI.: The Preparation and Properties of Tertiary Aromatic Bismuthines and their Interaction with Organic and Inorganic Halogen Compounds": F. Challenger and L. R. Ridgway. IV. "Researches on Sulphuryl Chloride, Part I: Influence of Catalysts: A Convenient Method of Chlorinating Benzene": O Silberrad. V. "The Reaction Between Persulphates and Silver": G. I. Higson.

IV. Dr. Silberrad has found that sulphuryl chloride is an exceptionally good chlorinating agent for hydrocarbons, such as benzene, in the presence of aluminium chloride and similar catalysts, and a yield of 90 per cent. in the cold can be obtained in the further presence of sulphur. Unstable coloured compounds are produced during chlorination with sulphuryl chloride, and the author suggests that a study of these substances might throw light upon the mechanism of chlorination.

V. Dr. Higson, in his paper, gave an explanation of the action of persulphate solutions on photographic plates, hitherto held to be the dissolving of metallic silver and the formation of soluble silver persulphate. Persulphates were found to give with silver a black powder which is probably the unstable oxide Ag_3O_4, but in presence of gelatin this substance is not formed, and silver goes into solution. In both cases the solution increases in acidity. Hence the reaction is probably:—

$$S_2O_8'' + H_2O \longrightarrow 2HSO_4 + O \; ; \; 3Ag + 4O \longrightarrow Ag_3O_4.$$

Gelatin causes immediate decomposition of the peroxide and becomes oxidised, the silver dissolving as sulphate. The presence of silver ions was found to catalyse the decomposition of persulphates. The reaction is thus autocatalytic.

INSTITUTION OF RUBBER INDUSTRY.

The inaugural meeting of this new society, held in London on October 19, was attended by nearly 200 persons. Mr. J. H. C. Brooking, M.I.E.E., president, was in the chair, and Sir H. A. Wickham, the pioneer of the plantation rubber industry, was the guest of the evening. Mr. Brooking, in his inaugural address, referred to the origin of the Institution, definite suggestions for the inception of which were first made in 1919, and then traced in outline the various stages in the development of the rubber industry. The Institution, he said, was conceived on the lines of the great British engineering and chemical societies, and was especially meant to be of use to rubber manufacturers. Those societies dealt mainly with raw materials of constant composition, but the rubber industry had to work with basic materials which were often unstable, usually complex, and whose elaboration was for the most part carried out by judicious guesswork or by rule of thumb.

Sir Henry Wickham referred to his unsuccessful efforts to induce the Eastern planter to adopt the hard-cure process, and said that after many years' work, he had devised an automatic machine which he thought would satisfactorily obviate the necessity for conducting this process by hand. Mr. Rogers then read a paper on "India-rubber Manufacture," which was followed by a discussion.

A Manchester Section was inaugurated at a meeting held in the Midland Hotel, Manchester, on November 7. Mr. J. Mandleberg presided, and Dr. H. P. Stevens read a paper on "The Effect of Different Methods of Preparation on the Behaviour of Plantation Rubber in the Factory," in which he discussed various misconceptions concerning the coagulation of the latex, the so-called oxidation of crêpe rubber, and the still-existing prejudice of some manufacturers to use mineral acid for coagulating. He suggested that manufacturers should make greater use of the new organic accelerators, and that they would produce a more uniform product if they used rubber from the same estates for the same purposes.

On November 16 a second meeting was held in London, at which Sir Frank Swettenham presided, and Dr. Stevens read a revised version of the paper he had read at Manchester.

NATIONAL UNION OF SCIENTIFIC WORKERS.

At the annual council meeting, held in London on November 12, Prof. L. Bairstow, the retiring president, gave an address in which he dealt with the past year's activities and the problems before scientific workers. He said that there was much to be achieved before any pause could be contemplated, but the members could look back with pleasure to the friendships formed with kindred organisations, as these were an indication of solid progress. The machinery of the Union was working smoothly and the membership growing satisfactorily. In the Union's actions its ideals had been high and sound; this was evidenced by the statement submitted to the Inter-departmental Committee on Patents. The Union laid it down as a principle that rewards to inventors should be on the basis of (1) a return of out-of-pocket expenses, and (2) an adequate payment for the value of the work done. In applying these clauses to Government departments it interpreted them as covered by an adequate salary.

It did not appear that the advisers of the Government yet understood the part played by the scientific worker, and the Union was still in the midst of a campaign for their enlightenment. *Inter alia*, they did not appear to understand what scientific research really meant, and in the case of the Air Ministry, with which department he was most familiar, not one-tenth of the money voted for aeronautical research was, in reality, used for that purpose; most of it was expended on what scientific workers would call "technical development."

During the past year the War Office had attempted to encroach on the very limited resources of the universities, by suggesting that professors should have charge of secret laboratories working on life-destroying chemicals. The Union was not concerned with the moral aspect of chemical warfare, but it was concerned with the idea of the War Office attaching parts of the universities to itself; such action would cut at the roots of the freedom of the universities.

In conclusion, Prof. Bairstow spoke of the negotiations between the Union and the British Association of Chemists with the object of bringing the two associations into much closer co-operation; when this was accomplished he hoped that scientific workers would be able to be represented in Parliament by a scentific man.

Dr. Alan A. Griffith, of the Royal Aircraft Establishment, was elected president for the ensuing year, and Prof. J. Stanley Gardiner, president of the research council.

SOCIETY OF DYERS AND COLOURISTS.

A meeting of the Manchester Section was held on November 18, Prof. Knecht presiding, at which a paper on "The Tinctorial Properties of Some Synthetic Compounds Related to Plant Pigments," by Dr. A. E. Everest and A. J. Hall, was read by the former.

CORRESPONDENCE.

THE CAUSE OF "BROWN BAST" DISEASE IN RUBBER PLANTATIONS.

Sir,—Whatever virtue there may be in the physiological explanation of Brown Bast advanced by Dr. H. P. Stevens in your issue of July 30 (pp. 269—271 R), I am inclined to favour chronic nitrogen starvation as the basic cause.

Rubber lands, generally, are notoriously low in nitrogen, and the rubber tree is itself a nitrogen robber. The only possible supply of nitrogen to the trees of any clean-weeded estate is from the nitrates produced by the frequent thunderstorms, and only a very small portion of this supply can be available to the tree. A critical limit must be reached sooner or later, and thereafter disease must follow. What is more natural than that the nitrogenous latex should be first curtailed? Growth may not be inhibited, because nitrogen is not so essential for growth.

Mycologists may now have given up all hope of isolating the Brown Bast germ, but the physiological idea could not have appealed very much to them or they would not have pursued their hopeless quest so long. Further, I do not think that chemists will be enamoured of the supposition until the ghost of nitrogen starvation has been well and truly laid. I am aware that some spasmodic experiments have been carried out by the F.M.S. Department of Agriculture in, I think, the Klang district, with a view to testing the effect of nitrates and ammonium salts on the yield of latex, but nothing of an exhaustive nature has to my knowledge ever been attempted. Chemists have been occupied far too long in matters pertaining to coagulation and vulcanisation; but now that competition with Para need not be such a bugbear, attention ought to be turned to better methods of cultivation, otherwise all attempts at seed selection will be in vain.

Forty pounds of 18 per cent. superphosphate will double the wheat yield of the Victorian mallee, and an equivalent amount of difficultly soluble nitrogenous manure, such as oilcake, might stop the rot in the plantations of *Hevea Brasiliensis*.—I am, Sir, etc.,

G. O. Ramsay.

Talbot, Vic., Australia.
October 1, 1921.

NEWS AND NOTES.

BRITISH INDIA.

Crop Forecasts.—Estimates of the areas under indigo, groundnuts (first forecasts), sugar cane, and sesamum (second forecasts) for the present season are given in the appended table, which also shows the increase or decrease as compared with the forecasts at the same period of last year:—

	Estimated Areas. 1,000 acres.	Inc. or dec. per cent.
Indigo	237·3	+31
Groundnut	1,489	+ 3
Sugar cane	2,426	— 5
Sesamum	2,698	+21

The yield of indigo is estimated at 2050 tons, an increase of 860 tons over the yield estimated at the same time in 1920. The state and prospects of the indigo, sugar cane, and sesamum crops are reported to be generally good.—(*Ind. Tr. J.*, *Oct.* 27, 1921.)

Cinchona Plantations in Bengal.—According to the Annual Report on the Government Cinchona Plantations and Factory in Bengal for the year 1920–21, the plantations are still suffering from the excessive exploitation practised during the war, but the results are better than they appear. The total acreage under cinchona is 3236 (of which 2340 is less than six years old), there are approximately 5·4 million trees, and the total harvest was 501,018 lb. of dry bark.

Factory Work.—The amount of mixed plantation barks used was 617,018 lb., which consisted of 216,106 lb. of Mungpoo and 400,912 lb. of Munsong bark, containing 4·72 and 4·4 per cent. quinine respectively. About 92 per cent. of the quinine in the bark was extracted, and the products were 23,984¾ lb. of quinine sulphate, 386 lb. of hydrochloride (equivalent to 431 lb. of sulphate), and 10,626½ lb. of cinchona febrifuge containing 1,269¾ lb. of quinine sulphate. The total output of all sorts from plantation bark was 34,997¼ lb. In addition, 655 lb. of sulphate and 196 lb. of cinchona febrifuge was manufactured from 10,600 lb. of Java bark for the Indian Government.

Cost and Value of Plantation Bark.—The Mungpoo harvest of 176,214 lb. cost Rs. 39,647. Its average quinine content being 4·72 per cent., with a unit rate of 2 annas, its value per lb. was 9·4 annas, or its total value Rs. 1,03,515. The Munsong harvest of 324,804 lb. cost Rs. 54,810; the bark contained an average of 4·4 per cent. of quinine, and its market value was at least 8·8 annas per lb., or a total of Rs. 1,78.642. The cost of the total harvest was Rs. 94,457, as against a market value of Rs. 2,82,167 (*cf.* J., 1921, 126 R).

Manufacture of Glass with Natural Alkali.—In the August number of the *Journal of Indian Industries and Labour*, J. P. Srivastava and D. Sinha propose the use, as a glass maker's alkali, of crude sodium carbonate extracted from certain kinds of saline efflorescences which occur in the soil over large tracts of land in India during the dry season. Such efflorescences differ very widely in composition but usually one constituent, such as potassium nitrate or sodium sulphate, chloride or carbonate, predominates over all others. Those in which sodium carbonate is the chief constituent are known as *reh* or *sajji-matti*. They occur extensively in land of little or no agricultural value, and large quantities of crude alkali or *sajji* are recovered from them annually by the *Lunias*, a class of men whose chief occupation is the collection of such deposits. The top layers of the soil, to a depth of 1 in. or less, are scraped off, and the scrapings are extracted with water on a primitive form of sand filter constructed between mud walls. The solution obtained is evaporated by solar heat in large shallow masonry tanks, and the residue or *sajji* is carted to the cities for sale. *Sajji* contains usually about 50 per cent. of sodium carbonate, 35 per cent. of moisture, and smaller amounts of sodium sulphate and chloride besides insoluble and organic matters. If care is taken in the selection of suitable deposits of *reh*, it is possible to obtain *sajji* practically free from sodium chloride, and very large quantities of such *reh* are available in certain districts. Large-scale operations in an experimental factory at Cawnpore have shown that by roasting *sajji* containing only 0·2—0·4 per cent. of sodium chloride in a specially constructed reverberatory furnace at 800° C., a glass-maker's soda can be produced containing 80—85 per cent. of sodium carbonate. This is quite suitable for the manufacture of glass for bangle-making and other purposes for which a fine product is not essential, and it is estimated that the cost of manufacturing such glass will always be at least 30 per cent. lower than if imported soda were employed.

CANADA.

Pulp and Paper Industry.—The Canadian paper and pulp industry has been depressed for some time, and many of the mills have been compelled to reduce output and, in some cases, to close down. The Canadian paper mills produced in 1920 about 850,000 tons of newsprint. The mills are equipped, at present, to turn out approximately 1 million tons per annum. Canada has been marketing about 80 per cent. of its newsprint in the United States. European paper has been reaching the latter market causing a decrease in demand and resulting in a decline in price from $125 to $75 per ton. Notwithstanding signs of improvement, it is doubtful if much pulp wood will be cut this winter, as there are enormous stocks of raw material, in the streams and stacked, which were contracted for when prices were high. This pulp wood must be worked up at an early date otherwise deterioration may render much of it valueless.

Price Bros., Ltd., a company in which many British investors are interested, has declared a quarterly dividend of one-half of one per cent. on the outstanding $42,683,200 of common stock. This is equivalent to 10 per cent. per annum on the old stock, as, by last year's reorganisation, holders of each share of the old issue received five shares of the new common. Until recently the dividend has been on the basis of 15 per cent. on the old stock. The Howard Smith Paper Mills, Ltd., of Montreal, has opened its new pulp mill at Cornwall, Ontario. This company is erecting an electrolytic bleach plant in connexion with the mill. Seattle (Washington, U.S.A.) capitalists propose to establish a large pulp mill near Atlin, B.C. The financial position of the Riordon Paper Company shows no sign of improvement. The mill at Kipawa, Western Quebec, is resuming operations to use up the wood, in the stream, upon which banking institutions have made advances.

The Animal and Vegetable Oil Industry in 1918.—Twenty-four plants were engaged in the manufacture or refining of vegetable or animal oils in Canada in 1918. The total assets of the industry amounted to $4,572,409 and the selling value of the products to $7,165,209. Seven plants produced 2,144,120 gallons of crude and 738,091 galls. of refined linseed oil, worth altogether $4,063,328, or 75 per cent. of the total for the whole industry; this production was derived from 34 per cent. of the 4 million bushels of flaxseed consumed in Canada in 1918. The output of the 24 firms had a value of $7,165,259, the chief items, excluding linseed oil, being:—Fish and cottonseed oils, refined, 54,000 galls.; lard oil 64,725 galls.; tallow 247 tons; stearin 178 t.; oilcake 24,366 t. Imports of animal and vegetable oils were valued at $8,353,104.

JAPAN.

The Alcohol Industry in Formosa.—The production of alcohol from molasses in Formosa dates only from 1907, but it has expanded rapidly, and alcohol from Formosa has driven both the Japanese product and imported alcohol from the Japanese market. The export to Japan increased to 2,482,732 galls. in 1918, but fell to 2,810,860 galls. and 1,798,274 galls. in 1919 and 1920 respectively; about 80 per cent. of the alcohol imported into Japan is used industrially. Owing to competition from the Dutch East Indies the exports to China decreased from 924,000 galls. in 1917 to 10,560 galls. in 1920, and during the same period the export to Hongkong fell from 294,360 galls. to 3,960 galls. It is stated that rice and potatoes are now being used to some extent in Formosa for the production of alcohol, but that molasses is still the chief raw material employed.—(*Ind. Tr. J., Oct.* 6, 1921.)

SOUTH AFRICA.

Iron-ore Deposits near Walvis Bay.—The deposits of iron-ore situated in the Namib Desert, south-east of Walvis Bay, are of sedimentary origin and, with one exception, consist of itabirite. Despite the magnitude of the deposits on the Von Broen and Murray claims, none of them appears to be capable, even with selective mining and sorting, of yielding commercial quantities of ore with an average content of more than about 50 per cent. of iron and less than about 18 per cent. of silica. Transport of such poor material by rail to Pretoria or Vereeniging is impracticable, as immense supplies of similar ores are available in the Transvaal. Moreover, neither export nor smelting on the spot is possible, so that the deposits are evidently not worth exploiting as a source of iron. Gold and silver was found in the itabirite from Von Broen's claim, but not in sufficient quantity to warrant exploitation.—(*S. Afr. J. Ind., Sept.*, 1921.)

UNITED STATES.

Helium Production.—The U.S. Government plant at Fort Worth, Texas, is now producing over 290,000 cb. ft. of helium a month, at a cost of 20 cents. per cb. ft., but it is anticipated that this cost will be reduced by one-half when the plant is working at full capacity. After the helium has been extracted the natural gas is transported in pipe-lines and consumed throughout northern Texas. Over $7,000,000 has been spent on the plant since it was started during the war (*cf.* J., 1920, 92, 113, 252, 436 R).—(*Oil, Paint and Drug Rep., Oct.* 10, 1921.)

The Synthetic Organic Chemical Industry.—A new organisation termed "The Synthetic Organic Chemical Manufacturers' Association of the United States" was inaugurated at meetings held in Washington on October 28 and 29. Briefly stated, its objects are to encourage the manufacture of all kinds of organic chemicals, to co-operate with the Government agencies in promoting the welfare of the industry, and by collective action to establish its independence and permanence. The Association is divided into four sections, viz., dyestuffs, pharmaceutical chemicals, intermediates, and fine organic chemicals; each section will have its own offices and the general administration will be entrusted to a board of governors, consisting of the president, Dr. C. H. Herty, four vice-presidents, a secretary, and an executive committee.

Platinum and Allied Metals in 1920.—Platinum metals are won in the United States in California, Oregon, Alaska, and Washington, but the output is quite insufficient for domestic requirements, which were apparently about 141,500 oz. troy in 1920. Sales of the crude metal in that year were 613 oz. troy, which yielded 488 oz. of refined metals (platinum 59%, iridium 16%, palladium and osmiridium 5%); in 1919 sales were 683 oz. crude, containing 503 oz. refined platinum metals. Imports of platinum in 1920 were:—Unmanufactured, 80,955 oz.; manufactured, for chemical use, 781 oz.; allied metals, 15,711 oz.; total, 100,546 oz., worth $8,568,907. By value England supplied 43·4 per cent. of the imports, Colombia 32·6 and France 15·7 per cent. Exports of platinum totalled 1350 oz., and stocks at December 31, 1920, 67,508 oz., compared with 43,432 oz. a year previously. Over 57 per cent. of the platinum metals used was consumed by jewellers, 19 per cent. by the electrical industry, 10 per cent. by the chemical industry, and 11 per cent. by dentists. Average prices per oz. troy of the platinum metals during the year were:—Platinum, $111; palladium, $108; iridium, $331; osmiridium, $150. The world's production of crude platinum in 1919 and 1920 is estimated to have been:—

	1919.	1920.
	Oz. troy.	
New South Wales	213	—
Tasmania	1,670	2,009*
Canada	30	25
Colombia	35,000	35,000
Russia	30,000	35,000
United States	824	613

* All osmiridium.

Platinum metals are said to have been found in paying quantities at Franklin Camp, British Columbia; and small amounts of the metals were produced in Canada at the refineries of the International Nickel Co. The only other development recorded is the use of more dredges in Colombia.—(*U.S. Geol. Surv., Sept.* 9, 1921.)

GENERAL.

The German Incandescent Gas-mantle Industry During the War.—Addressing the 22nd Conference of the Deutsche Beleuchtungstechnische Gesellschaft, Dr. Geisel of the Auer Gesellschaft remarked that in 1910 Germany manufactured 120 million gas-mantles, of which more than one-half was exported. The raw materials employed were almost without exception imported. When war broke out supplies of monazite sand sufficient to meet the gas-mantle industry's requirements in thorium and cerium nitrates for ten years were in stock, but there was a deficiency of ramie, and whereas the Auerlichtgesellschaft used 1 ton of this material daily before the war, in 1918 a daily supply of only 18 kg. was available Supplies of artificial silk to the same company amounted to only 80—100 kg. in 1918 and finally failed entirely, and resort was then had to paper fibre for mantle manufacture. Such a process of manufacture was beset with difficulties, but these were ultimately overcome and a mantle was produced in which paper fibre constituted the impregnated material and which possessed from 60—70 per cent. of the lighting efficiency of the ramie-impregnated mantle. Paper-crêpe was used to strengthen the tops of upright mantles, and difficulties encountered owing to the failure of supplies of asbestos necessary for drawing the ends together and for supporting the mantle were overcome by using up pre-war stocks of short lengths of asbestos fibre which were formerly regarded as worthless. These supplies being gradually exhausted, iron wire had to be used in place of asbestos fibre, and was found satisfactory under the prevailing conditions of gas supply, as owing to the smaller flame afforded by the supply of low-grade gas necessitated by the coal shortage, the wire was not subjected to the direct influence of the flame. In tne case of the inverted mantle, the mantle proper was affixed to its supporting magnesite ring by an enamel. During the war, supplies of collodion, camphor, etc., necessary for collodionising the mantles were available only in very small quantities and phenol condensation products were used as substitutes. Despite efforts made by other countries during the war to establish a gas-mantle industry, the lecturer anticipated that in a short time Germany would recover her former pre-eminent position in this trade, and remarked that England already experienced great difficulty in preventing the importation of mantles of German origin.—(*Schweiz. Chem.-Z., Sept.* 27, 1921.)

The German Salt Industry.—The efforts made during the past 18 months to form a syndicate for the German salt industry have not yet succeeded because several firms have insisted upon obtaining certain advantages as a condition of their adherence. A provisional organisation has, however, been established, and the recalcitrant firms have been given until October 25 to decide if they will come in or not. Should the syndicate come into being, it would at once proceed to regulate prices, for these have been anything but uniform, having recently fluctuated between 400 and 800 marks per 10-ton wagon. As these prices are well below the cost of production, the syndicate, if formed, would probably raise them immediately. Exports of salt are regulated by a special organisation, the Steinsalzausfuhrgesellschaft; in 1920 they amounted to 1,253,317·4 metric tons, valued at 438·9 million paper marks, as compared with 432,107 t., worth 4·9 million gold marks, in 1913. The exports in May and June of this year were 352,140 t. and 515,183 t., of which the United States took 16,858 t. and 43,285 t., respectively. Exportation to England of products of the German salt industry has always been very small.

Water-Power Development.—Prof. A. H. Gibson gave some interesting notes on this subject at the recent meeting of the British Association in Edinburgh. Although one of the oldest sources of industrial power, at least two-thirds of the water power now in use has been developed within the last ten years. In France and Switzerland the horse-power utilised has been doubled since the beginning of the war and in Spain quadrupled, with further large developments pending. In Italy 2 million h.-p. will shortly be utilised, Japan has developed over 1 million h.-p. since 1916, whilst in Canada and the United States many large schemes have recently been brought forward. Rapid development of water power in the United States has for a long time been retarded by insecurity of tenure, but since June, 1920, when the Federal Water Power Act came into force, the rate of development has increased considerably.

Taking the maximum useful flow of a stream as being that which may be guaranteed during six months of the year, the following figures show the available and developed water power of the world, in millions of horse-power.

	Available.	Developed.
Great Britain	0·9	0·2
Canada	23·0	3·28*
Remainder of British Empire, including		
Australia	30·0 to 50·0	0·7
Africa (East)		
,, (South)		
,, (West)		
British Guiana		
India and Ceylon		
New Zealand		
Papua		
Austria	6·5	0·57
Brazil	26·0	0·32
Dutch East Indies	5·5	—
France	5·6	1·6
Germany	1·5	0·75
Iceland	4·0	1·0†
Italy	4·0	1·25
Japan	8·0	1·5
Norway	7·5	1·25
Russia	20·0	1·0
Spain	5·0	0·88
Sweden	6·2	1·2
Switzerland	4·0	1·4
United States of America	28·0	9·8

* Including projected extensions to plants now in operation.
† Projected but not yet constructed.

In the United Kingdom, although there is only a comparatively small amount of water power available, and that chiefly in Scotland, yet it is estimated that, if all were utilised, some 27 per cent. of the present demand for power for industrial purposes could be supplied. A large proportion of the hydro-electric energy developed is likely to be used for industrial purposes, and for lighting, heating and traction; considerable extension of its use for electro-chemical and electro-metallurgical industries are anticipated.

The chief modern tendencies in water-power development are in the direction of increased size, capacity, reliability and efficiency of units, and of improvements in the design of turbines and their settings to allow of increased rotative speed in low-head turbines and of higher heads of water being used with those of the reaction type. Much attention has recently been paid to the question of utilising the power of the tides, but owing to the novel aspect of the problems involved a good deal of research work must be carried out to provide the necessary data before much progress can be expected. Research is also badly needed in connexion with ordinary hydro-electric problems and the establishment of a research laboratory, where the design and performance of turbines, conduits, pressure tunnels and dams could be studied on a fairly large scale and data relative to corrosion and the average run-off of various catchment areas could be accumulated, would be of immense service to the community.

Progress of the Flax Industry in Kenya Colony.—An interim report on the progress of the flax industry, recently issued by the Director of Agriculture in Kenya Colony (British East Africa), shows that great progress has been made in flax growing since hostilities ceased. In 1918 the area under flax was 8000—9000 acres, but this was increased to 25,000 acres in 1920, when the total value of the crop amounted to £456,000. At the end of June, 1920, 68 mills with 1252 scutching wheels were either in working order or in course of erection.

Experts have reported very highly on the quality of the flax grown, which compares favourably with high-class European flax, but the Agricultural Department has in mind possible improvements. Variety trials and experiments on different methods of retting are in progress, and the results have been valuable and instructive. Present indications point to the higher altitudes with their colder climates and heavier rainfall as being the best-suited for flax growing. The local supply of seed is now quite sufficient. Present methods of marketing are expensive, and the question of establishing one or more central flax markets in the colony is under consideration. A flax association has already been formed and one of its first acts has been to agree to the introduction of a system of flax grading, which will be in charge of two officers of the Agricultural Department.

Metallurgy in Brazil.—The Brazilian mining industry received a great impetus through the war-time shortage of minerals, and in particular the mining of manganese ore was greatly developed, thanks to the American demand. Owing to the lack of fuel for smelting then experienced, an investigation was begun of the country's reserves in coal. Reports received from Belgium and England on coal from the Rio Grande do Sul and Santa Catharina mines state that 1 metric ton yielded 600 kg. of good metallurgical coke with 18 per cent. ash, 59 kg. tar, 12 kg. benzol, 14 kg. ammonium sulphate, and 4750 cb. metres of gas. Attention has also been given to the utilisation of hydro-electric power for metallurgical purposes, and it is evident that the Brazilian Government is actively promoting the development of a domestic metallurgical, and especially of an iron, industry.—(*Schweiz. Chem.-Z., Aug.* 30, 1921.)

PERSONALIA.

Dr. W. S. Denham, lecturer in chemistry at the St. Mary's Hospital Medical School, has been appointed director of research to the British Silk Research Association.

Mr. R. G. Parker, a member of the chemical staff of the British Dyestuffs Corporation (Huddersfield), Ltd., has been appointed director of the British Launderers' Research Association.

The Senate of Cambridge University has presented an address to Dr. G. D. Liveing, professor of chemistry in the University from 1861 to 1908, who matriculated 75 years ago and has kept by residence every term since that time.

Mr. A. G. Craig, managing director of Arthur T. Dimmock, Ltd., and a director of Messrs. Allen, Craig and Co. (London), Ltd., has succeeded Prof. W. R. Hodgkinson as chairman of the executive committee of the Chemical Industry Club.

Dr. A. Lauder has resigned the hon. secretaryship of the Edinburgh and East of Scotland Section of this Society, and Mr. W. T. L. Williamson, also of the Edinburgh and East of Scotland College of Agriculture, has been appointed to succeed him.

The following awards have been made by the President and Council of the Royal Society:—A Royal Medal to Dr. F. F. Blackman, for his researches on the gaseous exchange in plants and on the operation of limiting factors. The Davy Medal to Prof. P. A. Guye, for his researches in physical chemistry. The Copley Medal to Sir Joseph Larmor and the Hughes Medal to Prof. N. Bohr, for their researches in mathematical and theoretical physics, respectively.

The Council of the University of Leeds has appointed Mr. E. C. Williams to be research chemist under the Joint Benzol Research Committee (*cf.* J., 1921, 350 R). Mr. Williams headed the list of First Class Honours candidates in Chemistry at Manchester University in 1914, served two years in the army, and has recently been working under the British Dyestuffs Corporation, Ltd., as head of the department for the manufacture of intermediate products at the Dalton Works, Huddersfield.

Prof. R. O. Herzog has been appointed director of the Kaiser-Wilhelm Institute for Textile Chemistry in Berlin.

Dr. H. Wieland has been appointed to succeed Prof. H. Führer as ordinary professor of pharmacology in the University of Königsberg.

Dr. E. I. Emmanuel has been appointed by the Greek Government to succeed Prof. H. Dambergis as professor of pharmaceutical chemistry in the National University at Athens.

Dr. E. D. Winkworth has been appointed executive vice-president of the Solvay Process Co., and will take full charge of the management of that company and of the Semet-Solvay Co., U.S.A.

The Swedish Academy of Sciences has awarded the Nobel Prize for chemistry for 1920 to Prof. Walter Nernst. The award of the prizes for chemistry and physics for 1921 has been postponed.

Dr. A. W. Davison, who has been appointed professor of chemistry at the Rensselaer Polytechnic Institute, was formerly professor of physical and electro-chemistry in the University of Cincinnati. During the war he was in charge of the 50-ton mustard-gas plant at Buffalo.

Prof. C. Neuberg, who represents biochemistry in the University of Berlin, has been offered a chair and the directorship of the Biochemical Institute in the University of Nagoya, Japan. Prof. Neuberg has been asked to select another German chemist for the post if he is unable to accept it.

Dr. Charles H. Herty has resigned the editorship of the *Journal of Industrial and Engineering Chemistry* in order to become president of the newly-formed Synthetic Organic Chemical Manufacturers' Association (*cf.* this issue p. 433 R). The vacant post has been filled by the appointment of Mr. Harrison E. Howe, formerly manager of the commercial department of A. D. Little, Inc., of Boston, and latterly head of the Division of Research Extension of the National Research Council.

Mr. W. P. Evans, chairman of Evans, Sons, Lescher and Webb, Ltd., died on November 8, aged 63 years.

Dr. Sheridan Delépine, professor of public health and bacteriology, and director of the public health laboratories of the University of Manchester, died on November 13, at the age of 66 years. In 1910 and 1911 Prof. Delépine read papers before the Manchester Section of this Society on chemical disinfectants.

The death is announced of Prof. Abeljanz, who recently retired from the chair of chemistry in the University of Zürich; of Dr. U. Kreusler, formerly professor of chemistry and technology in the Agricultural "Hochschule" at Bonn; and of Dr. E. Kunheim, proprietor of the firm Kunheim and Co., which is said to be the only undertaking in the German chemical industry which remains under private control.

The chairman of the American Section intimates the recent death of Mr. John W. Smith, an original member of this Society, who was born in Leeds, England, in 1849 and went to America in 1883, where he became associated with the Massachusetts Institute of Technology and founded a course in textile chemistry and dyeing. He resigned from the Institute in 1902, and from that time was connected with the chemical and dyestuff industries in Boston.

PARLIAMENTARY NEWS.

HOUSE OF LORDS.

Safeguarding of Industries Act.

The question of the effect of this Act upon scientific research was raised by the Marquess of Crewe, who quoted letters to show that many research chemicals had now to be prepared in the laboratory either because the 33⅓ per cent. duty had made them too costly or because the operation of the Act involved serious delay in deliveries. Out of 1863 research chemicals contained in a German price-list, only 36 or 37 per cent. was made in England; the manufacturers would make a further 10 per cent. if a market could be found, but they would not be able to make the remainder under any circumstances. Many items contained in the Board of Trade list, *e.g.*, rare-earth metals, were not prepared in this country and were unlikely to be. Further difficulties were caused by the poor quality of certain glassware and the excessive cost of materials to students. He therefore invited the Government to see what could be done to mitigate these grievances.

Lord Haldane emphasised the importance of efficient equipment to research work, and commented on the high cost of microscopes and the lack of staining reagents for microscope preparations; and Lord Buckmaster contended that, owing to the absence of competition, the prices of laboratory glassware had increased by from 400 to 500 per cent. above pre-war prices.

In reply, Viscount Peel said that the object of Section 1 of the Act was to promote the manufacture in this country of products of national importance, and a moderate degree of security was necessary to induce manufacturers to establish works and train workmen to produce them. A large proportion of these products was consumed in scientific, educational, and industrial institutions, and were the requirements of these institutions to be exempted, the assistance given to the new industries by the Act would be greatly limited. When these industries were on a firm basis, there would be a larger demand for chemical and scientific workers, and this would be a great advantage. It might be possible, however, to exclude certain articles from the Schedule if they were unlikely to be manufactured in this country. All he could do at present was to bring the question before the Minister of Education.—(Nov. 10.)

HOUSE OF COMMONS.

Board of Trade Returns.

Answering Mr. G. Barker, Mr. Baldwin said that the returns of the Board relating to the trade of foreign countries and British Possessions would be issued quarterly instead of monthly, but the returns of the trade of the United Kingdom would still be issued each month.—(Nov. 7.)

Imports and Exports of Iron and Steel.

Mr. Baldwin, in reply to Major Kelly, stated that the total imports into the United Kingdom of iron and steel products in September was 206,127 tons, valued at £1,830,000, and the total exports 133,324 t., worth £4,082,000. The home production of iron and steel products, so far as statistics were available, amounted to 945,600 tons.—(Nov. 7.)

American Exports of Coal to Europe.

In a statistical answer to Mr. G. Barker, Mr. Bridgeman stated that the exports of coal from the United States to Europe during the period Jan.—Aug., 1921, were 4,834,991 tons of bituminous coal and 10,586 tons of anthracite. The average declared value, f.o.b. American ports, of bituminous coal fell from \$8·81 in January to \$6·44 in August.—(Nov. 7.)

Coal Output.

Replying to Sir W. Davison, Mr. Bridgeman said that the average output of coal per man per shift had been over 17 cwt. in 1921, but it was increasing, and in September rose to 18·5 cwt.; in the year before the war it was 21 cwt.—(Nov. 9.)

German China and Earthenware.

In answer to Lt.-Col. J. Ward, Mr. Baldwin said he was aware of the unemployment in the pottery trade, but official statistics did not suggest any large importation of porcelain, china, and earthenware from Germany. There was no legal provision requiring imported china to be marked with the country of origin, but he hoped to introduce amending legislation early next session.—(Nov. 10.)

Home-Grown Sugar, Ltd.

Sir A. Boscawen, in reply to Lt.-Col. Willey, stated that the Government had a nominee on the board of the company. It was possible that the proposed minimum guaranteed price for next year's beet was below the present cost of production, but in addition to benefiting from any decrease in costs of production, the farmer would share equally with the company profits derived from any increase in sugar content above 16 per cent. and of sugar price above £43 per ton duty paid. The excise duty on home-grown sugar was 19s. 5¼d. per cwt., as compared with 25s. 8d. on foreign and 21s. 4½d. on colonial sugar.—(Nov. 10.)

German Munitions Plant.

Sir L. Worthington-Evans informed Mr. Woolcock that all special plant not necessary for the authorised requirements of the German army and police had been or was being destroyed or rendered useless for the manufacture of war material. Certain plant intended for the manufacture of military material was being re-converted to peace production under the supervision of the Inter-Allied Commission of Control. There had been no departure from the provisions of the Peace Treaty.—(Nov. 10.)

Railway Charges (Merchandise).

Mr. Neal, answering Sir A. Yeo, said that the increased rates of September, 1920, were intended to secure sufficient additional revenue in 11 months to balance the financial results of the first 18 months of control, but any general reduction in rates before the end of Government possession was made impossible by the trade depression and the coal stoppage. Any representative body of traders could apply for reductions in railway rates to the Railway Rates Tribunal, under Section 60 of the Railways Act, 1921.—(Nov. 10.)

Pharmacy Acts Amendment Bill.

Capt. O'Grady introduced a Bill to regularise the position of all persons trading as chemists and druggists or pharmacy-store proprietors in the sale of drugs, the dispensing of doctors' prescriptions, and the sale of patent medicines. The Bill includes the following proposals:—That from January 1, 1925, the Institute of Chemistry shall alone have power to authorise the use of the title "chemist," and that a person now entitled to style himself a "chemist and druggist" shall cease to use the title "chemist." That the power to place a person on the pharmaceutical register be granted to the Incorporated Society of Pharmacy and Drug Store Proprietors of Great Britain, Ltd., under like conditions to those granted to the Institute. That a central council be formed to include four members appointed by the British Medical Association, four by the Institute of Chemistry, four by the Pharmaceutical Society, four by the Pharmacy Society, and a chairman appointed by the Privy Council. That no medicinal article be advertised to cure more than three diseases or complaints of similar pathological nature; and that the issue of such advertisement be sanctioned by the central council. —(Nov. 3.)

Safeguarding of Industries Act.

The following are summaries of answers given by the President of the Board of Trade to questions relating to the operation of the Act:—

Development of New Industries.—Certain articles dutiable under Part I. of the Act were not being manufactured in the British Empire at the time the Act was passed. The object of this part of the Act is to encourage the development of the industries concerned, and steps are already being taken in this direction.—(Nov. 7, 10.)

Representation by Counsel.—Complainants may be represented by counsel, but the Board of Trade will not employ counsel unless the complainants are so represented.—(Nov. 9.)

Potassium Chlorate was included in the Board of Trade list without the qualifying letter "R." The error has been officially notified and any duty paid on this substance not of "R" quality will be refunded.—(Nov. 9.)

Scientific Glassware.—Certain types of measuring and test glasses, whether graduated or not, are scientific glassware and therefore dutiable. Glass jugs are not dutiable, and no duty has been levied on small tumblers.—(Nov. 9.)

Tungsten Wire.—The Commissioners of Customs and Excise are considering the possibility of establishing standard values for tungsten wire used in electric lamps.—(Nov. 10.)

French Exports.—Out of a total duty of £14,056 collected under Part I. of the Act between October 1 and October 28, the duty levied on goods consigned from France amounted to £1563.—(Nov. 10.)

German Exports.—The imposition of a rate of duty varying with fluctuations in the exchanges was fully considered before the Bill was introduced, but proved on examination to present grave difficulties.—(Nov. 10.)

Arc-lamp Carbons.—It has been claimed that the effect of the flat-rate duty is to impose a heavier charge on French than on German arc-lamp carbons, but the Government policy with reference to the duty cannot be reconsidered.—(Nov. 10.)

REPORTS.

Report on the Economic and Commercial Situation of Australia, Dated June, 1921. *By* S. W. B. McGregor, *H.M. Senior Trade Commissioner in Australia. Pp.* 88. *Department of Overseas Trade. London: H.M. Stationery Office.* 1921. *Price* 2*s*. 6*d*.

After a long period of abnormal prosperity due to war conditions, Australia is now suffering from grave economic depression: the country carries a heavy debt and large stocks of unsold commodities, and the mining industry has been paralysed by the refusal of the workers either to accept lower wages or to work longer hours. On the other hand, national finance is sound and well-managed, the authorities are pledged to economy, and the undeveloped resources of the country are very great.

The production of minerals in 1920 is given by the Australian Metal Exchange as follows:—Silver 1,376,429 oz.; lead 13,308 tons; zinc 33,907 t.; copper 26,186 t.; tin 4178 t.; and pig iron 344,000 t. The production of gold is estimated at 943,692 oz. Owing to a strike, the mines at Broken Hill remained inactive from May, 1919, to November, 1920; the stock of concentrates and slimes purchased by the Home Government and stored at Broken Hill exceeds 550,000 tons.

Developments in the chemical and related industries have already been noted in these columns, but it is noted that manufacturing industries in general can only progress if more capital and labour be obtained from overseas. The Government assists these industries by means of a highly protective customs tariff, and through the Institute of Science and Industry, definitively established in September, 1920, and the Bureau of Commerce and Industry, which will shortly be created a permanent Department. Owing to the high import duties several home firms, *e.g.*, Messrs. Cadbury Bros., Fry and Sons, and J. Pascall (*cf.* J., 1920, 320 R) are planning to manufacture in Australia, or are acquiring interests in Australian undertakings. Labour unrest is the chief factor limiting industrial development.

During the year ended June 30, 1920, imports were valued at £98,974,292 and exports at £149,823,509 (54% to the U.K.), but since that date the trade balance has become unfavourable. The competitive imports, worth £70,059,969, were supplied mainly by the United Kingdom (54·3%), the United States (25%), and Japan (5·4%); preliminary figures for the period July 1, 1920, to March 31, 1921, show that the British share is increasing.

Imports of drugs, chemicals and fertilisers in 1920–21 were valued at £3,648,755, as compared with £4,425,073 in 1918–19, and consisted of:—

	£	Chief Sources. Per cent.
Drugs and medicinal preparations	628,145	U.K. 45, U.S. 39.
Rock phosphates	330,544	—
Perfumery, etc., non-spirituous..	305,310	U.S. 44, U.K. 23.
Tartar, cream of	280,587	France 56, U.S. 19, U.K. 12.
Sulphur	205,714	U.S. 63, U.K. 1.
Tartaric acid	122,245	U.K. 60, Italy 37.
Calcium carbide	121,130	Norway 58, U.K. 12, U.S. 3.
Synthetic dyestuffs	120,656	U.K. 87, U.S. 7.
Sheep-dips	48,728	U.K. 98, U.S. 2.
Bacteriological products ..	37,833	U.S. 83, U.K. 15.

Importations of earthenware, cements, china, glass and stoneware fell in value from £1,467,886 in 1918–1919 to £1,239,685 in 1919–20, but rose to £2,546,430 for the nine months ended March 31 last. In 1919–20 the United Kingdom supplied most of the earthen- and stone-ware, and ranked second to Japan in the provision of china- and porcelain-ware; the supply of plate glass was shared between Belgium (44·4%), U.S.A. (42%), and U.K. (13·5%), and that of sheet glass between U.S.A. (39%), Belgium (27·6%), Japan (26·3%), and U.K. (5·2%).

Report on Economic and Financial Conditions in Mexico, 1920–21. *By* N. King, *H.M. Consul-General, Mexico City. Pp. 34. Department of Overseas Trade. London: H.M. Stationery Office.* 1921. *Price* 1s.

The fact that although Mexico has been in the throes of revolution for ten years, the Government revenues have doubled during this period, affords striking evidence of the country's wealth in natural resources, of which the most important are petroleum, silver, gold, copper, and lead. The principal crops are maize, agave, sugar-cane, barley, and wheat, and the chief raw materials exported are ixtle fibre, chicle gum, tobacco, hides and skins, and broom-root. There is an abundance of timber, dye-woods, and medicinal plants.

In 1920 the production of petroleum was approximately 162 million barrels, of which about 145·5 million brls. was exported to the United States (78%), South America (9%), the British Isles (4·2%), and Canada (1·5%).

The production of minerals and metals in 1919 and 1920 is stated to have been as follows:—

		1910.		1920.*
Gold ..	oz. troy	622,772·5	.. oz. troy	617,393·5
Silver ..	,,	54,231,461·6	.. ,,	52,380,555·2
Copper	metric tons	56,172	.. metric tons	46,057
Lead ..	,,	71,376	.. ,,	121,434
Zinc ..	,,	11,560	.. ,,	14,363
Mercury ..	,,	119	.. ,,	77
Antimony ..	,,	470·7	.. ,,	1,572·4
Graphite ..	,,	4,023	.. ,,	2,991·5
Tungsten ..	,	21·97	.. ,,	34·92
Tin	,,	1·59	.. ,,	——
Arsenic ..	,,	2,246·4	.. ,,	1,198·8
Manganese ..	,,	2,204	.. ,,	838·6
Molybdenum	,,	1·77	.. ,,	0·65

* The figures for 1920 are subject to revision.

About one million tons of good coking-coal was produced annually before the Revolution, but the production is now reduced to one-half. Reserves are conjectured to be 100 million tons.

Owing to the recent disturbances, there is very little reliable information concerning Mexican trade, but it is certain that the enormous losses of locomotives and rolling stock have made transport very difficult and led to congestion of goods and great losses to shipping. Among the commodities which appear to be in demand are caustic soda, cyanide, and other chemicals used in mining and soap manufacture, china- and glassware, tinplate, and iron sheets. British goods are favoured, but there are not more than about 3 millions of the inhabitants who can be regarded as potential consumers of them. Competition from the United States is very keen. In 1918 imports were valued at $276,217,464, and included chemical and pharmaceutical products worth $12,338,946, and minerals, metals, and manufactures thereof, valued at $124,323,54 (Mexican gold dollar = 2s. 0½d. at par). The United States supplied 89·6 per cent. of the total imports, the United Kingdom 3·5 per cent., and France 1·2 per cent.

Final Report of the Water-Power Committee of the Conjoint Board of Scientific Societies.

Reports received from the various oversea portions of the Empire are summarised to supplement the information contained in the preliminary and interim reports (*cf.* J., 1918, 320 R, and 1919, 212 R), and a tabular statement of the present state of investigation work is given which may be summarised as follows:—In Great Britain, India, Canada, New Zealand, and some portions of Australia, definite steps have been taken by the various Governments to investigate the water-power resources of their respective territories; in the Union of South Africa, British East Africa, Ceylon, British Guiana, and Egypt, preliminary steps only have been taken; and in the remaining countries of the Empire very little, if anything at all, has been done. Taking the Empire as a whole, no attempt has been made to estimate its total resources, to systematise the investigations which are going on, or to collate such information as has been gathered.

Referring to other countries, Brazil has developed about 320,000 h.-p. of the 26 millions available, Iceland is proposing to develop over one million of the 4 million h.-p. estimated as the minimum total, and Japan has developed, or is developing, over one million horse-power.

The latest available statistics are those compiled by Mr. Arthur Surveyer, of Montreal, and Prof. Luigi Luiggi, of Italy, and are summed up as follows:—

	Hydraulic horse-power.		
	Available.	Developed.	Per cent. of available now developed.
Europe: Germany, Italy, Switzerland, Spain, Sweden, Austria-Hungary, France and Norway	47,300,000	8,450,000	18·0
United States	32,000,000	6,500,000	20·3
British Empire	60,000,000	3,000,000	5·0

Canada possesses about 72 per cent. of the total developed water-power of the Empire and in the following table that given above has been reconstituted so as to show Canada and the United States together as North America:—

	Hydraulic horse-power.		
	Available.	Developed.	Per cent. of available now developed.
Europe	47,300,000	8,450,000	18·0
North America	50,800,000	8,805,000	17·3
British Empire (except Canada)	41,200,000	695,000	1·7

The Committee makes a number of suggestions as to the principal objects to be carried out by the Imperial Water-Power Board, whose appointment was proposed in the preliminary report, with the idea of unifying and systematising the work, and rendering the results, records and data easily available.

The Committee recommends that the Conjoint Board should urge upon the Government:—(1) That adequate measures be taken to develop the immense water-power resources of the Empire. (2) That in many parts of the Empire records of river-flow be instituted and maintained. (3) That an Imperial Water-Power Board is needed to stimulate, coordinate, and assist water-power development. (4) That an Imperial Water-Power Conference be convened in London at an early date.

With this report the Committee concludes its work. A combined edition of its three reports will be published shortly.

OFFICIAL TRADE INTELLIGENCE.

(*From the Board of Trade Journal for November* 10 *and* 17.)

TARIFF, CUSTOMS, EXCISE.

Austria.—"Luxury" goods on which customs duties have to be paid in gold include certain wares of paper, rubber, various celluloid and related products, glassware of specified kinds, wares of nickel and aluminium, optical instruments, vinegar, fats and oils, alcoholic aromatic essences, perfumery, fine soap, explosives, etc.

British India.—The export duty on Indian lac has been fixed at 4 annas per maund, and on refuse lac at 2 annas per maund.

Canada.—With certain exceptions, imported china and crockeryware consisting of more than one piece must be marked with the name of the country of origin.

France and Algeria.—The "general" tariff rate of duty on potassium chloride and potassium sulphate has been increased to 30 fr. per 100 kg.; both products are admitted duty-free under the "minimum" tariff.

Germany.—Regulations controlling the import and export of goods to and from warehouses have been issued.

Bone waste, bone grits, and animal sinews may be imported without licence as from November 1. When imported by sea coal is assessed for the coal tax on the f.o.b. price at the foreign port of loading and when imported over land on the pit price. As from November 20 customs duties are re-imposed on dextrin and various starch adhesives, gluten, certain flours, glucose, dextrose, maltose, yeast, wood and other pulps.

Italy.—The stamp tax on mirrors has been amended.

Export licences are no longer required for alloys, lead scrap, leucite, lubricating oils, and potassium salts other than fertilisers.

Nyasaland.—The import duties on cement, petrol, motor spirit, lubricating oils, iron sheets and bars, scents, perfumed spirits, etc., have been revised. Quinine, drugs of the British Pharmacopœia (under certain conditions), coal, etc., are placed on the free list.

Spain.—A Royal Commission has been appointed to consider how far the development of Spanish chemical industries can be promoted by protective tariffs.

Sweden.—Regulations affecting the manufacture and sale of margarine, margarine cheese, and artificial lard provide that margarine must contain not less than 0·1 per cent. and not more than 0·2 per cent. of potato starch, and that margarine cheese must contain a quantity of sesamum oil equivalent to at least 5 per cent. of the fat and vegetable oils used in the manufacture, exclusive of the sesamum oil.

Switzerland.—Restrictions on the importation of certain goods are continued in force until September 30, 1922.

Trinidad.—Regulations governing the invoice and certificate of value for goods entered under the British preferential tariff have been issued.

Turkey.—As from October 18, the pre-war duty of 11 per cent. *ad valorem* is again applied.

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1, from firms, agents or individuals who desire to represent U.K. manufacturers or exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department and quoting the specific reference number.

Locality of firm or agent.	Materials.	Reference number.
Australia	Crockery, glassware, enamelware	*
Canada	Clinical thermometers	397
"	Structural steel..	6848/E.D./ S.C.2/A.
"	Zinc oxide, whiting, sulphur, lampblack, litharge, lithopone, mineral rubber, coal tar, thiocarbanilide, barytes	6944/E.D./ S.C.2.
"	Copper, brass, spelter, lead. antimony and white-metal alloys	424
"	Celluloid sheets	†
South Africa ..	Crockery	401
"	Chemicals for the bakery, mineral-water, confectionery, and allied trades	402
Austria	Hides, skins, leather, tanning materials	404
France	Steel products	520
Germany	East Indian kips, sheep and goat skins	406
Spain	Coal	407
"	Chemical and pharmaceutical products	431
"	Anti-friction metal	432
"	Sulphate of ammonia	433
Switzerland ..	Linseed oil, turpentine ..	410
Egypt	Paper, Bristol board, strawboard	6463/F.E./ P.N.
"	Chemicals, oils, paint, asbestos	6534/F.E. P.N.
Syria	Chemicals, pharmaceutical products	411
China	Leather, window glass, mirrors, yellow soap	435
United States ..	China clay, asbestos, iron and steel scrap, soap, coke, refractories, plumbago crucibles, ferro-alloys, electric-furnace carbons	414
" ..	Mining chemicals	417
" ..	Chinaware	436
Argentina ..	Sheet and plate glass	418
" ..	Chemicals, glass, plate glass (tender for).	
Mexico	Tinplate, leather, crockery, tyres	442
Uruguay	Cement, printing paper and ink	443

* Ref. No. 412/20/7/729, Official Secretary, Commonwealth of Australia, Commercial Information Bureau, Australia House, London, W.C. 2.

† Canadian Government Trade Commissioner, Portland House, 73, Basinghall Street, London, E.C. 2.

GOVERNMENT ORDERS AND NOTICES.

ADVISORY COMMITTEE FOR THE COAL INDUSTRY.—The Secretary for Mines has appointed Sir A. R. Duncan to act as chairman of the Advisory Committee for Coal and the Coal Industry, established under Section 4 of the Mining Industry Act, 1920. Sir George T. Beilby, Sir John Cadman, and Dr. J. S. Haldane have been appointed to represent the medical and other sciences, and Mr. F. S. Starling, of the Mines Department, to act as secretary.

Coal Mines Act.—The Secretary for Mines has made an Order relating to the testing of mine-dust mixtures containing gypsum and prescribing that such mixtures shall be dried at a temperature not exceeding 275° F., instead of 212° F., in order to ascertain their moisture content. In other respects the procedure is the same as in the standard test laid down in General Regulation 4 of July 30, 1920, made under the Coal Mines Act, 1911.

Certificates in Chemistry.—The Secretary of the Board of Education announces that an agreement has been made under which the Institute of Chemistry and the Board will issue jointly certificates in pure and applied chemistry to students in technical schools in England and Wales who have successfully completed approved courses. The Institute will consider later whether and how far the higher certificates can be regarded as a qualification for admission to the examination for the Associateship. Details of the scheme have been issued by the Board in pamphlet form. [Rules 100. 1921. 2d.]

Safeguarding of Industries Act.—The Board of Trade has received complaints under Section 1 (5) of the Act that incandescent gas mantles and calcium carbide have been improperly excluded from the lists of articles published by the Board. The Incandescent Mantle Manufacturers' Association is the complainant in the first case and the British Cellulose and Chemical Manufacturing Co. in the second. The hearings are fixed for December 3 and 10, respectively, and persons directly interested in either dispute are asked to communicate immediately with the complainants, or with the Board.

TRADE NOTES.

BRITISH.

The Dye Market in India.—Imports of dyeing and tanning materials into India in 1920—21 rose in value by Rs.1·5 crore to Rs.3·02 crore, of which Germany supplied 35, the United Kingdom 27, and the U.S.A. 21 per cent. The principal items were aniline worth Rs.2·23 crore (U.K. 31%, Germany 29%) and alizarin valued at Rs.55 lakhs (U.K. 17%, Germany 67%). Trade with Germany has increased owing to the removal of restrictions on the importation of synthetic dyestuffs. Among imports from Great Britain were large quantities of reparation dyes. The distribution of dyestuffs in India is controlled in order that consumers may not be charged exorbitant prices.—(*Times Tr. Supp., Nov.* 12, 1921.)

Northern Territories of the Gold Coast in 1919.—The chief crops grown in this Colony are beans, groundnuts, maize, various cereals, cotton, tobacco, and sisal, and the area under cultivation is steadily increasing. Gold-bearing quartz and alluvial deposits occur near Wa and in the Bole district but are not worked owing to lack of transport facilities. Favourable reports on specimens of mica from the north-west province have been received, but the outcrops have not yet been investigated. Iron ore is smelted by the natives in various localities, and salt is produced by evaporation at Daboya. No details are given of the trade of the Protectorate, but it is stated that there was an increase in the exports of shea butter, extracted from the fruit of *Butyrospermum Parkii*, and of "dawa dawa," a food made from the locust bean (*Parkia filicoidea*).—(*Col. Rep.-Ann., No.* 1082, 1921.)

Nyasaland in 1919–20.—The agricultural development of Nyasaland is now passing through a very critical period; the value of land has increased by about 140 per cent. since 1914, and many settlers have sold their estates and left the country. The cotton crop declined by 79 tons to 262 t., but the production of fibre shows signs of increasing. There was a reduced demand for capsicums and chillies, which were used in the manufacture of "tear" shells during the war. The investigation of the coal and other mineral deposits was continued by the Government Geologist. Imports were valued at £606,624, of which the United Kingdom supplied 61 and British Possessions 17 per cent.; 99 per cent. of the exports, valued at £430,223, was directed to the United Kingdom. The prospects of the Protectorate are held to be promising; transport is improving and increasing numbers of settlers are arriving. The cultivation of cotton and sisal hemp should develop into important industries.—(*Col. Rep.-Ann., No.* 1075, 1921.)

REVIEWS.

The Physical Properties of Colloidal Solutions. *By* E. F. Burton. *Second edition. Pp.* viii+221. (*London: Longmans, Green and Co.* 1921.) *Price* 12*s*. 6*d. net.*

Les Colloïdes, Leurs Gelées and Leurs Solutions. *By* Paul Bary. *Pp.* xii.+508. (*Paris: Dunod.* 1921.) *Price* 50 *francs.*

Burton's work, the first edition of which appeared in 1914, deals almost exclusively with the suspensoid sols. This limitation is very natural in a book written for physicists by one of them, but it may cause disappointment to many readers, and the familiar statements regarding the technical importance of the discipline are a little difficult to support on this basis. The portion of the subject chosen by the author is treated very lucidly and in great—sometimes perhaps excessive—detail: the general reader will hardly require a verbatim quotation of Rayleigh's exposition of microscopic image formation. A long and admirable chapter is devoted to the Brownian movement, and the author gives an original deduction to show why the law of logarithmic distribution cannot apply to columns of any considerable height, a point ignored in most text-books. As might be expected, the chapters on the electrical properties and coagulation are also excellent, and recent literature has been fully utilised in criticising the "valency rules." The author, in this connexion, makes some very striking suggestions regarding the great difference between uni- and tervalent ions, which it is hoped he will test experimentally.

A few statements are open to controversy, as is, indeed, inevitable in the present state of the subject. One of these perhaps deserves mention: the author distinguishes between sols in which the disperse phase is a pure substance, and those in which electrolytes are necessary for stability. The most general view is certainly that the former class is non-existent, and that in all cases definite ions are required in a stable sol. This, and a few similar points, in no way detract from the value of the book, which can be thoroughly recommended to all students who look for more than mere "tips" of immediate technical utility.

Bary's book is in many respects a very remarkable work. In mere bulk it exceeds every existing text-book devoted to the subject. It contains an enormous mass of material, the selection of which not only proves a comprehensive knowledge of the literature, but is strikingly original in many cases, and its presentation conforms to the high national standard of lucidity and of formal logical development. The reviewer finds himself in lively sympathy with several features, such as the elaborate treatment of gels, the phenomena of swelling and the properties of non-aqueous systems (the author exhibits a marked partiality to india-rubber). It is more difficult to be with him when he deliberately abandons the modern views regarding the generality of the colloidal state and goes back—at any rate in the chronological sense—to purely chemical theories. A large section of the book is devoted to "La Colloidité" and to developing the thesis that sol-formation is bound up with polymerisation. In cases in which the author himself excludes this possibility, *e.g.*, with salts of univalent metals, he draws distinctions which, to the student of modern English and German literature, will seem entirely arbitrary. Non-aqueous sols and gels of NaCl, and hydrosols of AgI and AgBr are known which, to the majority of observers, will appear as completely typical as the preparations in which polymerisation is possible. It is impossible within the limits of a brief review to discuss this fundamental question.

The treatment of the recognised aspects of the subject, such as viscosity, electrical properties, coagulation, etc. is very complete, and throughout takes into consideration recent literature. Only one very important addition to our knowledge appears to have been overlooked: the examinations of colloidal particles by X-ray interference, by Debye and Scherrer (1917 and since). They bear directly on the question of the density of ultramicroscopic particles: as gold particles containing only a few hundred atoms have the same space-lattice as solid gold they must have the same density, a point on which the author is sceptical; they also seem to show the very great rareness of a truly "amorphous" state, to which he attaches importance.

The mere size of the book will probably deter beginners from its study. It will prove stimulating to readers familiar with the subject, especially to those who do not dislike having their convictions challenged by the able presentation of very unfamiliar views.

Emil Hatschek.

Ceramic Industries Pocket Book. *By* A. B. Searle. *Pp.* vii+267. (*London: Sir Isaac Pitman and Sons, Ltd.* 1920.) *Price* 8*s.* 6*d. net.*

This pocket-book contains in a handy form, not only a number of data constantly required by those engaged in ceramic industries, but also a large amount of information which might be wanted at any time, and might necessitate a long search to find. It is one difficulty of the subject that information on it is widely scattered and not always easily accessible.

The author has wisely extended the term "ceramic" to include several industries which at first sight would appear to be outside its scope, and it is to be regretted that he has not discussed rather more fully the classification on pages 1 and 11—12. It must be borne in mind, that a book of this kind, whilst written primarily for those engaged in ceramic industries, will be welcomed by many not actually concerned with the manufacture but with the selection and purchase of ceramic products, and for them a clear explanation of many technical terms would be of great assistance. Many of these are given, but somewhat noticeable exceptions are:—"on-glaze" and "under-glaze" colours, "engobe," etc., and although not susceptible of exact definition, an explanation, for example, of "crazing," "dunted ware," "softening point" and "squatting temperature" would have been valuable.

A large portion of the book is given up to mensuration, mechanics, and engineering data. Although this information is undoubtedly useful, the question not unnaturally arises as to the advisability of including it in a book of this kind, because it would ordinarily be sought in engineering pocket-books, and one feels that much of this space could have been more profitably devoted to purely ceramic matters. If a certain amount of mathematics is included short tables of logarithms and trigonometrical formulæ might certainly have been inserted. The arrangement of the subject matter in a book of this kind must always be a difficult problem, but the inclusion of the physical constants of porcelain among notes on clays is rather a surprise. The inclusion of more physical data of ceramic products, such as expansion and conductivity, in particular, would have been of great service, or even the table compiled by Wologdine with special reference to refractory materials. A description of the physical testing and chemical analysis of ceramic materials and products would also have been much appreciated by readers who are concerned with the selection and use of such products, and are consequently interested in the interpretation of the results of tests, and are often at a loss to appreciate their significance.

The typographical errors are comparatively few and unimportant. On page 15, line 25, "air compounds" should apparently be "iron compounds," and the specific gravity of crystobalite on page 25, should be 2·33 instead of 2·65.

The concluding section of the book, on ceramic calculations, is very clearly set out, and will be of great use to students as well as those engaged in pottery manufacture, and the full working out of actual examples will enable the uninitiated to master the subject.

Though differences of opinion may exist as to the selection and arrangement of the subject-matter of the book, there is no doubt that this compact little volume will be valued by those engaged in the various branches of the ceramic industries, who will realise that it fills a gap which no other book of its size has hitherto done.

Walter C. Hancock.

OBITUARY.

F. W. PASSMORE.

Francis William Passmore, who died suddenly on October 29, was born in London in 1868, his father being the sub-editor of the *Pharmaceutical Journal*. His chemical training began in the laboratory of the late Dr. B. H. Paul, to whom he was articled for five years, and was continued at the school of the Pharmaceutical Society and at the University of Würzburg under Emil Fischer, who subsequently wrote of him:—"I regard him as one of the most talented of my pupils; he possesses an extraordinary gift for observation and chemical research." After two years' study in Würzburg he obtained the degree of Ph.D., *summa cum laude*.

Returning to England, he served as assistant demonstrator in the research laboratory of the Pharmaceutical Society, under Prof. W. R. Dunstan, and in 1892 he started practice, with Mr. H. Helbing, as a consulting chemist in London, the partnership being subsequently dissolved. In this sphere he was very successful and became widely known as an authority in legal matters relating to chemical patents. Among the cases in which his assistance was requisitioned were actions connected with lanolin, rhodamine dyes, ionone, synthetic musk, sulphur dyes, aspirin, metal-filament lamps, saccharin, bleaching of flour, artificial silk, and fat-hardening.

Dr. Passmore was the first to start the manufacture of saccharin in England on a commercial scale (1902); he perfected and worked a process for making synthetic camphor, and was one of the first to manufacture phenol-formaldehyde condensation products; and several other industrial processes owe much to his scientific knowledge and technical skill. He had a high standard of professional honour, his outlook was broad and eminently just. The needy ever had his sympathy and practical help, and those with whom he worked looked up to him with affection and respect. His untimely death leaves a sense of irreparable loss.

E. T. Brewis.

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Technical Records of Explosives Supply. 1915—1918. No. 4. The Theory and Practice of Acid Mixing. *Pp.* 93. *Ministry of Munitions and Department of Scientific and Industrial Research. (London: H.M. Stationery Office.* 1921.) *Price* 12*s*.

The Emission of Electricity from Hot Bodies. *By* O. W. Richardson. *Monographs on Physics. Second edition. Pp.* 320. *(London: Longmans, Green and Co.* 1921.) *Price* 16*s*.

Elementary Chemical Microscopy. *By* E. M. Chamot. *Second edition, partly rewritten and enlarged. Pp.* 479. *(New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.* 1921.) *Price* 25*s*.

A Text-Book of Inorganic Chemistry. *By* A. F. Holleman. *Issued in English in co-operation with* H. C. Cooper. *Sixth English edition, revised. Pp.* 527. *(New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.* 1921.) *Price* 19*s*.

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Electrodeposition and Electroplating. *A General Discussion held by the Faraday Society at Sheffield, on November* 19, 1920. *Reprinted from the Transactions of the Faraday Society, Vol. XVI., Part* 3, 1921. *Price* 10*s*. 6*d*.

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- Regulation of Explosives in the United States. *By* C. E. Munroe. *Price* 10 *cents.*
- Accidents at Metallurgical Works in the United States in 1919. *By* W. W. Adams. *Price* 5 *cents.*
- The Detection and Estimation of Platinum in Ores. *By* C. W. Davis. *Price* 5 *cents.*
- Analysis of Iowa Coals. *By* G. S. Rice, A. C. Fieldner, *and* F. D. Osgood. *Price* 5 *cents.*
- Ventilation in Metal Mines. *By* D. Harrington. *Price* 10 *cents.*
- Flotation Tests of Idaho Ores. *By* C. A. Wright, J. G. Parmelee, *and* J. T. Norton. *Price* 25 *cents.*
- Pennsylvania Mining Statutes Annotated. *By* J. W. Thompson. *Price* $1.
- Metal-Mine Accidents in the United States during 1919. *By* W. W. Adams. *Price* 10 *cents.*
- Permeation of Oxygen Breathing Apparatus by Gases and Vapours. *By* A. C. Fieldner, S. H. Katz, *and* S. P. Kinney. *Price* 10 *cents.*
- The Relative Safety of Brass, Copper, and Steel Gauzes in Miners' Flame Safety-Lamps. *By* L. C. Ilsley *and* A. B. Hooker. *Price* 10 *cents.*
- The Analysis of Sulphur Forms in Coal. *By* A. R. Powell. *Price* 5 *cents.*
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THE EFFECT OF THE WAR ON THE HEAVY CHEMICAL INDUSTRY.*

G. C. CLAYTON.

Sulphuric-Acid Manufacture.

The first effect of the war on the heavy chemical industry was to increase enormously the demand for sulphuric acid. Prior to the war the production of oleum and concentrated vitriol was small, merely a few hundred tons per week, but during hostilities all the sulphuric acid required for warlike purposes had to be concentrated or produced as oleum. The plants used for concentration were the Kessler, Gaillard towers, and cascade evaporators, constructed either of acid-resisting ferro-silicon or silica basins.

By these means the output of concentrated vitriol was increased to 7000 tons per week in the short period of 18 months. In providing the acid for this concentration every trade contributed, and the country was largely indebted to the fertiliser industry, which wholeheartedly delivered its vitriol to the concentrating works at great sacrifice. The output of oleum was increased from a few hundred tons to 7000 tons per week. The various types of plant employed were:—The Badische, the Grillo and Schroeder, the Tentelew, and the Mannheim—partial and complete. It is unnecessary to repeat the descriptions that have already been published of these plants and processes. During the war several processes were introduced to arrest the acid escaping from concentrating plants, of which the most efficient were the Cottrell precipitator and the Fox scrubber. Excellent descriptions of the Cottrell precipitator have appeared in various publications.

The Fox scrubber for removal of sulphuric acid from concentrator-exits in substitution for the coke-scrubber consists of a lead cylinder 3 ft. in diameter and 5 ft. long, with tapered ends containing three or more diaphragms of 10-lb. lead placed very close together and perforated with $\frac{1}{8}$ in. to $\frac{5}{32}$ in. holes. The pressure is regulated to 2 in. drop between inlet and outlet when the flow is 50 cb. ft. per second. The gases enter at 110—120° C. The Twaddell-reading of the acid collected is approximately represented by the same figure as the temperature in degrees Centigrade. The necessary draught is provided by a high-speed Kestner fan at the outlet.

The present position of the sulphuric-acid industry is indicated by the fact that many of the consuming industries are practically at a standstill, namely, those manufacturing fertilisers, dyes, and ammonium sulphate. This, of course, is only temporary, but the effect is that only the most economic plants can be operated without loss. Experience seems to show that for the lower strengths of acid the ordinary chamber process working with pyrites, either cupreous or washed, or spent oxide, is the most economical, whilst for the higher strengths the ordinary concentrating processes are being displaced by the manufacture of oleum, and subsequent dilution. A further alteration in chamber manufacture—largely due to war conditions—is the abandonment of nitre pots and the substitution of ammonia-oxidation plants. This has been brought about by the relatively high cost of nitre compared with that of ammonia, and the ammonia-oxidation process is so simple to work that the managers of vitriol plants would be loth, even at a slightly higher working cost, to return to the old nitre process.

The Leblanc Soda Industry.

Prior to the war the Leblanc industry was gradually being superseded owing to improvements in other processes and to the fact that it was relatively a heavy fuel-consumer and called for a large amount of labour. The first portion to die was the conversion of salt-cake into soda ash, but the manufacture of caustic soda from salt-cake was still flourishing at the commencement of the war, and, generally, the old Leblanc industry—which was the pioneer of the heavy chemical industry—still had life in it. We must all regret that its day has passed, as it furnished such an extraordinary number of by-products, all calling for scientific treatment and all capable of infinite modification.

Starting with vitriol, the Leblanc process gave us salt-cake, hydrochloric acid, nitre-cake, Chance sulphur, sodium sulphide, caustic soda, sodium carbonate, soda crystals, thiosulphate, sodium sulphite and bisulphite, Glauber's salt, chlorine, bleaching powder, chlorates, hypochlorite of soda, calcium and magnesium chlorides, and other products. Now, owing to the high cost of labour and fuel and the large extensions to electrolytic plant made during the war, this wonderful series of processes has practically ceased to be operated, except when the demand for one of the by-products helps to keep it remunerative. For many years before the war the Leblanc process was kept alive by these by-products and subsidiary processes, and now that it has been superseded by the ammonia-soda process and the electrolytic processes for the decomposition of salt, many of these by-products have to be made by more expensive methods as main products. It is interesting to follow out these products and find how they are now produced:—

Salt-Cake and Hydrochloric Acid.—Salt-cake is still produced, to the extent to which it is required, from salt and sulphuric acid, but as it is no longer converted into caustic soda, any additional hydrochloric acid that may be wanted will be made from electrolytic hydrogen and chlorine.

Nitre-Cake.—This will no longer be produced together with the nitrous gases required in vitriol manufacture, and, indeed, nitric acid itself can be more economically produced by oxidation of ammonia than from sodium nitrate and vitriol.

Chance Sulphur.—As alkali waste will no longer be produced, it is difficult at the moment to see how this wonderfully pure product can be obtained.

Sodium Sulphide is still produced from salt-cake by reduction, and it is also obtained as a by-product in the manufacture of barium carbonate by treating barium sulphide with sodium carbonate. Before the war sodium sulphide was made only on a comparatively small scale in this country for de-hairing hides, but its application has been greatly extended in the manufacture of sulphur dyes.

Sodium Carbonate and Bicarbonate are made solely by the ammonia-soda process.

Caustic Soda is made partly by causticising ammonia-soda and partly by electrolysing common salt. The two chief processes operated in this country are the mercury process, by the Castner-Kellner Co., and the Gibbs' diaphragm process, by the United Alkali Co. In both of these the products are chlorine, hydrogen, and caustic liquor. This liquor is concentrated in the same way as that from causticised ammonia-ash, but more and more use is being made of multiple-effect evaporators and similar fuel-saving devices.

Soda Crystals are made from ammonia-soda ash, or directly from the cathode-liquors of the Hargreaves process.

There has been no alteration in the method of manufacture of sodium thiosulphate, sulphite, bisulphite, or Glauber's salt.

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*From the chairman's address to the Liverpool Section, October 28, 1921.

Chlorine.—The Weldon and Deacon processes have been displaced by the electrolytic process. Electrolytic chlorine is produced mainly in Castner-Kellner, Gibbs, and Hargreaves cells, and is often liquefied. Two methods of liquefaction are used, viz., compression, in which the valves are lubricated with concentrated vitriol, and by direct liquefaction, which is more economical for large installations. Both these processes were worked during the war, and by the date of the armistice this country was in the position to produce more chlorine than the Ministry of Munitions required.

Bleaching Powder is still produced in Weldon chambers, Hasenclever cylinders, Deacon blocks, and more recently also in two types of mechanical cylinders designed by the Castner-Kellner and the United Alkali companies.

Chlorates.—As a result of the higher costs of labour and fuel, chlorates are now made only by direct electrolysis of the chlorides, and consequently calcium chloride, which was a by-product of chlorate manufacture, has to be made from the still liquors of the ammonia-soda process.

This rapid sketch of the Leblanc industry and its by-products will indicate the large alterations imposed by its abandonment.

As an adjunct to vitriol manufacture from cupreous pyrites, we have the wet copper process with its by-product of purple ore or briquettes. At present costs of fuel and labour, this process cannot be worked in the old hand-furnaces, and at the moment is uneconomical even when the mechanical Ramen furnaces are used.

The Ammonia-Soda Process.

There have been very slight changes in this process, which, except for certain mechanical details, is so perfect in efficiency that little real alteration appears possible. Latterly, however, it has been suggested to combine it with the synthetic-ammonia process in such a way that ammonia will be removed from the process as ammonium chloride. To a limited extent this method of producing ammonium chloride has been used for a long time, but by the later proposal it is suggested that, so far as is necessary, the ammonia utilised in the soda process shall be recovered as ammonium chloride, and that this will compete with ammonium sulphate as a fertiliser. Ammonium chloride has disadvantages compared with the sulphate, and its success or failure will largely depend upon the cost of sulphuric acid; its real interest is that it is a truly home-made product.

Ammonium Nitrate.

During the war enormous quantities of ammonium nitrate were made at the ammonia-soda works. Two methods were used:—

(1) Strong ammonia-liquor was carbonated in towers and the liquid run into solution of calcium nitrate. The ammonium nitrate solution was filtered to remove the precipitated calcium carbonated, concentrated in Kestner evaporators, and crystallised in revolving crystallisers. The salt produced was very pure, but the output—about 800 ton per week—was dependent on the supply of calcium nitrate from Norway.

(2) By double decomposition of sodium nitrate and ammonium sulphate. This process demands very skilful work, and Messrs. Brunner, Mond and Co. are to be sincerely congratulated on having elaborated it and worked it successfully. The production from this process ensured an adequate supply of ammonium nitrate to the Ministry of Munitions, although it must be noted that in this case also the supply of raw material came from overseas. To obviate this dependence in future, it is very desirable that we should have in this country an adequate number of synthetic-ammonia plants, if only for use in emergency.

Fertilisers.

During the war manufacturers of fertilisers had to make many sacrifices on account of the demands for explosives, but when these demands had been overtaken they were called upon to produce large quantities of fertilisers to augment the home production of foodstuffs. This industry, in common with every other industry, is now passing through a very trying period owing to the effect of the exchanges, but with the up-to-date plants now in this country, the industry—if not too heavily handicapped by high rates of exchange and excessive costs of labour—will ultimately regain its old position. A contributory trouble is that due to recent agricultural legislation, which is inducing the farmer to revert from arable to grass cultivation, with consequent diminution in the consumption of fertilisers.

Dye-Intermediates.

Closely associated with the heavy chemical industry is the production of dye-intermediates. Prior to the war this country had allowed the dye industry to be practically monopolised by Germany. We now all appreciate what this has meant in time of war, and we cannot afford to be in such a position again. There was, however, at least one plant for producing dinitrochlorobenzene, and this was speedily extended so that it produced regularly an output equivalent to 90 tons of dinitrophenol per week. Apart from the many plants erected during the war, largely for war purposes, there are now in this country several firms equipped with modern up-to-date plants. Unfortunately, owing to a legislative bungle, large quantities of German dyes were imported into this country, and this fact, coupled with the great depression in the textile trades, has resulted in a practically complete standstill in dye-making in this country. We cannot afford to allow the dye industry to fail, and it is satisfactory to note that legislation has been passed to nurse this industry during its difficulties in getting firmly established.

Prospects.

With regard to the future, I am unable to take the pessimistic view that our industry will not recover. Dark and uncertain as the future appears at the moment, we must not lose hold of the essentials of our success. What was the position before the war? Industrially, judged from the standpoint of foreign trade, we were apparently in an unassailable position; but it was evident then that the lethargy engendered by a surfeit of prosperity had to be shaken off if we were to maintain our position. But the fact remains that we had achieved that position and held it so long for certain very clear and well-understood reasons.

First, we owed it to our geographical position—the clearing house of the old and the new worlds—which made us the trading, banking and carrying nation of the world. Secondly, we had readily accessible and cheap supplies of coal and iron; withal, we were exempt apparently from the dread possibility of Continental warfare, with no great military commitments, and with our huge trade, taxation was comparatively low. But even more important than these, we had the solid British character—loyal, persevering, and conscientious. We were the great colonisers of the world; we were in consequence constantly opening up new spheres of influence which meant new markets for the industries of the country, and we were able, under humane and economic conditions, to produce at costs which could compete with those of other countries. If we are to continue as an industrial country, costs of production must come down; but that does not necessarily mean that wages must be drastically reduced to below pre-war rates, or that the standard of living need be lowered. What must be reduced is the cost of the unit. There must be more production per man, and the greater the production the greater the efficiency, and the greater the chance of success.

Our industry is of vital importance to the country. Its necessity was proved during the war; it is equally vital in times of peace. We must keep all our industries in the forefront, and we must largely depend on our chemists to do this, not only in the chemical industry, but in practically every other. No up-to-date works can afford to be without its chemist, and no chemist is of use unless he continues to study throughout his life.

THE TECHNICAL HYDROGENATION OF HYDROCARBONS, NITROBENZENE, ALKALOIDS, AND COAL.

The hydrogenation of unsaturated glycerides in the oil-hardening industry and the hydrogenation of nitrogen in the production of synthetic ammonia are such important processes that their discussion in the technical press has overshadowed many hydrogenation processes which have not the same potential industrial applications. There are several catalytic hydrogenation processes which are of commercial significance and others which are likely to command attention in the near future, and of these, it is proposed to consider in this article the hydrogenation of benzene to cyclohexane, of naphthalene to the tetra- and decahydro-derivatives, and of the unsaturated aliphatic hydrocarbons occurring in "cracked," low-boiling petroleum spirit. In addition, the production of hydro-alkaloids of therapeutic value, and the possibility of producing aniline by catalytic hydrogenation of nitrobenzene will be considered. Finally, reference will be made to the liquefaction of coal by hydrogenation.

The classical work of Sabatier, followed by that of Ipatiew, Paal, Skita, Willstätter and others, has laid a very sure foundation upon which to build almost any industrial process involving catalytic hydrogenation. The scope of the technical chemist lies in the selection of the most suitable catalyst from the number available—nickel, copper, iron, colloidal platinum and palladium, platinum and palladium black, etc.—and the adaptation of conditions to technical operation. In technical practice, too, purification methods very different from those used in laboratory experiments must be evolved before economic application of a process becomes possible. This is exemplified clearly in the production of tetrahydronaphthalene in Germany. Entirely new methods of purification had to be found before a simple hydrogenation, founded upon Sabatier's method, but carried out in the liquid state, could be applied.

Hydrogenation of Benzene.—The production of cyclohexane by catalytic hydrogenation of benzene does not appear to have found much technical application at present, although the hydrocarbon has been used in the production of synthetic rubber, and finds limited application, alone or in admixture with benzene, as a motor fuel. It is interesting, however, as showing the modification of conditions which must at times be made in the application of laboratory results to large-scale operations.

Thus, Sabatier found that the hydrogenation of benzene in presence of reduced nickel commenced at 70° C., and reached a maximum speed at about 180° C. At about 300° C., however, methane began to be formed and carbon to be deposited upon the catalyst. Similarly, Mailhe has recently noted (Chem. Zentr., 1921, I., 717), that at 300° C. a reversal of the reaction occurs, benzene and hydrogen being formed. On the other hand, the Dayton Metal Products Co. (English Patents Nos. 133,666 and 150,991) states that optimum conditions for the production of cyclohexane are a temperature of 300° C. and a pressure of 300 lb. The benzene vapour and hydrogen are continuously supplied under pressure to an electrically-heated cylinder containing a "cartridge" of catalyst—nickel oxide, platinum or palladium—which can be easily removed and replaced. The cyclohexane and unchanged benzene, if any, are condensed and excess of hydrogen is re-circulated. The reaction is exothermic, so that the electric heating may be dispensed with when reaction is well started, and often the insulating doors must be opened to allow radiation of heat. The process is controlled with the assistance of thermocouples, and the amount of cyclohexane in the condensate can be varied by regulating the speed of passage of the benzene-hydrogen mixture.

Hydrogenation of Naphthalene.—Naphthalene was successfully hydrogenated by Sabatier, Ipatiew, Willstätter and others, the classical methods associated with these names being employed. It was not, however, until the shortage of turpentine, solvents, lubricating oils, etc. caused Germany to seek substitutes that a technical process was evolved. The success attendant upon the efforts of the German technologists may be measured by the fact that the Tetralin G.m.b.H. possesses to-day at Rodleben, near Rosslau, a plant with a daily capacity of 120 tons of "Tetralin" (tetrahydronaphthalene).

The great obstacle to the technical hydrogenation of naphthalene was the difficulty of purifying it. In the laboratory experiments, expensive and tiresome recrystallisations had to be made before the hydrocarbon was obtained sufficiently pure for hydrogenation. These methods were inapplicable on a large scale, and the Tetralin Ges. finally discovered that the thionaphthenes and similar sulphur-containing substances present in commercial naphthalene, indicated by the red colour developed on triturating with strong sulphuric acid, could be removed completely by heating the naphthalene with absorbent substances, such as fullers' earth, kieselguhr, etc., together with an easily fusible metal (sodium or potassium) or with finely-divided nickel, etc. Carbides or amides can also be employed. The process is worked at present by stirring molten naphthalene at about 180° C. with the purifying agent, but according to early patents, naphthalene in the vapour state or in solution may be treated. The purified naphthalene, distilled into the hydrogenation autoclave, is treated with hydrogen at about 180°—200° C., and under a pressure of 225 lb., a supported nickel-catalyst being present. The purification is usually so efficient that several "runs" may be made with the same catalyst.

The reaction may be stopped at the stage when tetrahydronaphthalene has been produced, or the absorption of hydrogen may be continued to produce decahydronaphthalene. A mixture of the two, known on the market as "Tetralin Extra" can be manufactured, and if necessary the tetra-derivative may be separated from the more highly hydrogenated naphthalene by solution in liquid sulphur dioxide.

Decahydronaphthalene is a fully-saturated hydrocarbon, unattacked by sulphuric or sulphurous acid, and may be likened to the paraffin hydrocarbons. Tetrahydronaphthalene, on the other hand, has still one benzene nucleus not hydrogenated, and by reason of this many aromatic derivatives can be produced from it. Halogen, nitro, amino, hydroxy, alkyl, and aryl substituents may enter the aromatic ring, and such derivatives of "tetralin" will doubtless find a great many applications in the production of dyes, fine chemicals, etc. The chief wartime use of "tetralin," however, was as a turpentine substitute. It is true that heated controversy has taken place in German paint-trade circles, and the question of the suitability of "tetralin" cannot be regarded as settled. Thus, in 1920 a score of papers dealing with the subject appeared in the *Farben-Zeitung.* The large quantities of "tetralin" already produced and the potential production of the Tetralin Ges. appear to indicate a favourable result. It has also been suggested to use tetrahydronaphthalene as a motor fuel, as an illuminating oil, as a solvent for rubber, hydrocarbons, fats, dyes, ethereal oils, etc., as an insecticide, and for producing a lubricating oil by condensation with derivatives. It is probable, however, that it will be chiefly used in the preparation of varnishes, lacquers, etc. and, like benzene, as a starting point in the production of dyes, etc.

Hydrogenation of "Cracked" Petrols.—The low-boiling petroleum spirit produced by any of the standard "cracking" processes now used on a large scale in America, is invariably highly unsaturated, as compared with "natural" petrol. Large losses are incurred in the refining treatment, and often the unsaturated hydrocarbons are not removed, as is shown by analysis of some present-day motor spirits. Spirits containing di-olefines are especially liable to deposit resinous condensation-products on storage. Hence, if a successful hydrogenation treatment could be worked, say, on lines similar to those described under "Hydrogenation of Benzene" (*cf. s.*), or by hydrogenation in the liquid condition under very high pressure, refining losses would disappear, and a spirit equal in every respect to a natural distillate would be obtained.

Sabatier has demonstrated the possibility of hydrogenating liquid olefines to yield the corresponding paraffins, employing his usual methods. A direct application of his fundamental methods or a suitable modification could probably be worked if sulphurous impurities, etc. were removed from the "cracked" spirit. The problem seems to be very similar to that opened up in the case of commercial naphthalene (*cf. s.*).

Hydrogenation of Nitrobenzene.—The manufacture of aniline is usually carried out by reducing nitrobenzene with iron and water, a little hydrochloric acid being added at the beginning of the process. The type of aniline "machine" is well known, and the cost of the process is low, especially if the hydrated iron oxide produced can be disposed of at a reasonable figure, say for purifying coal gas or water gas. An efficient catalytic process seems, however, to offer attractions and the fundamental reactions and requisite catalyst have been carefully studied by Sabatier.

Nitrobenzene is reduced to aniline by hydrogen in the presence of reduced nickel at about 180° C., but, unless a catalyst of low activity is employed, hydrogenation of the benzene nucleus also takes place, and cyclohexylamine is produced. By substituting reduced copper for nickel, however, the reaction stops at the production of aniline. Thus, at about 300° C., a mixture of nitrobenzene vapour and excess of hydrogen produces aniline in almost theoretical yield when passed over catalytic copper. The catalyst remains active for a long time, and when de-activated, can be easily regenerated.[1] Moreover, the cheaper water gas can be used in place of hydrogen.

Upon the basis of the above work of Sabatier, the Badische Anilin- und Sodafabrik has patented a process (French Patent No. 511,256), in which a mixture of carbon monoxide and steam, or water gas and steam, react with nitrobenzene in the presence of a copper catalyst to form aniline. The efficiency of the catalyst may be increased by adding promoters, such as the oxides of the alkali and other metals, phosphates, silicates, tungstates, compounds of tellurium, and antimony. The reaction is stated to take place at about 200°—220° C., excess of carbon monoxide being used, and steam in the proportion of at least one molecule to three of carbon monoxide. Although about 20,000 cb. ft. of hydrogen is theoretically required to produce one ton of aniline, the process would seem to be easily operated, and also cheaper than the iron-reduction method from the point of view of the cost of rectifying the aniline. If water gas could be employed without decreasing the speed of reaction or lessening the conversion (in which case a mixture of aniline and nitrobenzene, troublesome to rectify, would result) the catalytic process would seem to have a future. Reduced copper as a catalyst has the advantage over nickel, in that it is easier to regenerate.

The hydrogenation of nitrobenzene, in the liquid state, to aniline, in the presence of nickel as catalyst, is suggested by Brochet (Eng. Pat. 1913, Nos. 16,936 and 22,523). The advantages of using a method similar to those employed in hydrogenating fat will be obvious, but unless a fairly inactive catalyst be employed it is probable that cyclohexylamine would be produced in considerable quantity. For the production of pure aniline, it is very probable that excessively slow reaction would be induced—even if complete hydrogenation could be effected at all—with the inactive catalyst necessary to prevent production of cyclohexylamine.

In the Brochet process, nitrobenzene is mixed with about 1 per cent. of nickel and vigorously agitated with hydrogen at about 100° C. In the presence of 0·5 per cent. of caustic soda, intermediate products may be obtained. The absorption of hydrogen is less rapid than in the direct reduction to aniline, in the absence of caustic soda, but the process can be stopped at any required point, and azoxy-, azo-, and hydrazobenzene can be obtained. It is stated that the benzene nucleus is not hydrogenated, although it is claimed that by the same method phenol can be almost quantitatively converted into cyclohexanol.

The practical certainty that a product contaminated with cyclohexylamine would be produced when nickel is used as catalyst, and the inability of copper to induce the hydrogenation of the benzene nucleus, whilst readily acting in the reduction of the nitro-group, would render it probable that the Sabatier process will ultimately replace the older reduction method by means of iron borings and water. The specific catalytic influence of reduced copper is shown in many reactions, of which the reduction of phenylethylene and phenylacetylene to phenylethane may be noted. In the presence of nickel, hydrogenation of the nucleus also takes place, ethylcyclobenzene being produced.[2]

Hydrogenation of Alkaloids.—Many hydro-alkaloids have properties widely different from those of the original alkaloid, and in certain cases their toxicity is diminished. Tetrahydrocolchicin is less poisonous than colchicin, and is most readily prepared by passing hydrogen through an aqueous alcoholic solution of the alkaloid, in which a small amount of colloidal palladium is suspended. When absorption of hydrogen is complete, the alcohol is evaporated, and the tetrahydrocolchicin is extracted with chloroform. From the solution in chloroform the hydro-alkaloid is easily obtained as an amorphous mass, melting at about 100° C. (Eng. Pat., 1914, No. 12,336. Roche and Hoffmann.)

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[1] Legge and Adam (Eng. Pat. 166,249 and 166,283) have recently described a copper catalyst which is very efficient, conducts heat very well, and can be easily regenerated. Copper oxide is fused, cooled, and broken up into suitably-sized pieces for promoting the hydrogenation of nitrobenzene as vapour. Hydrogen or water gas in excess is mixed with nitrobenzene, and quantitative yields of aniline are obtained on passage over the catalyst at 230° C.

[2] Colloidal palladium has been successfully used in the catalytic reduction of nitrobenzene to aniline, but colloidal copper is useless

In a somewhat similar manner quinine, morphine, codeine, etc. may be hydrogenated in aqueous solution of their salts. (Vereinigte Chinin Fabriken, Zimmer; British Patents 1913, Nos. 10,206 and 14,247.) The alkaloid is added to aqueous formic acid, which is decomposed by the platinum catalyst in the cold, although the reaction may be finished at 50° C. if required. The hydrogen liberated is taken up by the alkaloid and the product is easily isolated from the solution. In a similar way, but using nickel suboxide as catalyst, and in aqueous media, Boehringer effects the hydrogenation of quinine, morphine, cinnamylcocaine, etc. (Eng. Pat., 1914, No. 21,883.) The temperature is maintained at about the normal or only slightly raised, and the hydrogen pressure may be slightly positive. The details of the processes need not be quoted, as the methods are in common use in laboratory experiments. There are but few technical problems associated with the hydrogenation of alkaloids, the quantities to be treated are relatively small, and the laboratory methods require but little modification. The patent literature on this subject contains little of interest or novelty.

Hydrogenation of Coal.—The liquefaction of coal by hydrogenating a proportion of its constituents with formation of liquid tars, oils, and valuable derivatives has attracted considerable attention, but little tangible success has yet been reached. Claims have been made in Germany on behalf of the Bergius process,[3] but no definite scientific information is available. It is stated that coal is treated in suitable autoclaves at 400° C. and at high pressures of hydrogen. (It will be remembered that Berthelot obtained an artificial petroleum by the action of hydriodic acid upon coal in sealed tubes.) The first of a series of papers by Fischer and Schrader has recently appeared in *Brennstoff-Chemie* (1921, II., 161), in which the liquefaction of coal by means of sodium formate is described. Thus, if a Rhenish lignite be distilled destructively, about 7 per cent. of tar is obtained; but if it be mixed with four times its weight of sodium formate, the yield is 23—27 per cent., and even greater if the pressure of the gaseous decomposition products and the steam be kept constant. Thus 45 per cent. of tar was obtained from a mixture of 1 part lignite and 2 parts sodium formate, and 48 per cent. from a mixture containing 1 part of the fuel and 8 parts of the salt. The increased production of liquid products is attributed to the influence of the nascent hydrogen formed on the decomposition of the formate used. Molecular hydrogen, as in the Bergius process, is stated to have very little effect.

The experiments can scarcely be said to have progressed far, and it would be useless to criticise the apparent impracticability of the process as it stands at the moment. It is, however, probable that more economical methods will be discovered which will lead to the same result, namely, the conversion of coal and peat substances into more valuable raw materials. Thus, Fischer and Schrader (Brennstoff-Chem., 1921, II., 257) have examined the action of carbon monoxide upon coal during distillation. In the presence of carbon monoxide at ordinary pressure little advantage results, but increased pressure, and temperatures such as 500° C., lead to better yields of tar than when hydrogen is used (*cf.* the Bergius process). The process, however, does not give such successful yields as when sodium formate is employed.

NEWS FROM THE SECTIONS.

EDINBURGH AND EAST OF SCOTLAND.

The second ordinary meeting of the present session was held in Edinburgh on November 15, Dr. H. E. Watt in the chair. A paper on "Phyto-Synthesis" was read by Mr. W. O. Kermack, in which an attempt was made to give a general idea of the present state of our knowledge of the more important aspects of the synthesis of carbon compounds in plants, the work of Moore, Baly, and Robinson receiving special attention.

The synthetical activities of living matter are concerned with the elaboration of carbon chains and hydro-aromatic and aromatic compounds, and with the superficial adjustment of such carbon skeletons by reduction, oxidation, abstraction of water, etc. This takes place at low temperatures smoothly and efficiently, and, at first sight, contrasts with laboratory operations. The living cell can accomplish its work by a systematic use of catalytic agents, and fundamental is the function of chlorophyll in photo-catalysing the formation of the carbohydrates from carbon dioxide. The organism can also make use of reversible reactions, and by removing the products can enable synthetical activity to proceed; or, it may make extensive use of a few simple smooth reactions, as Robinson assumes in his theory of the synthesis of alkaloids and other compounds in plants. An insight into phyto-synthesis will suggest new problems and new methods, for, compared with the work of the cell, our synthetical achievements seem painfully laborious and crude.

SHAWINIGAN FALLS.

A well-attended meeting of this Section was held on November 16. Dr. Skirrow presided, and Mr. Harold J. Roast, of the James Robertson Co. and McGill University, secretary of the Canadian Institute of Chemistry, gave an address entitled "The Inner Life and Activity of Metals."

The lecturer discussed the crystalline nature of all pure metals, and explained why fineness of grain meant a stronger metal, and why the ductility of malleable iron was so much greater than that of ordinary gray iron. He then described the toxic effects of certain metals and metalloids, whose presence in mere traces often had a very marked and deleterious effect on the quality of the alloys containing them, and referred to copper which when containing small quantities of bismuth could be sawn in a manner similar to hard wood, whereas pure copper was most difficult to saw. Treatment of the "pathological" condition of metallic alloys was shown to be, to some extent, analogous to the treatment of pathological states in man; and the structure of bearing metals was illustrated by slides, which gave a clear idea of the part played by their various components.

YORKSHIRE.

The first meeting of the session was held in Leeds on November 21. Dr. L. L. Lloyd took the chair and announced that Mr. S. H. Davies, the chairman of the Section, was still absent owing to illness. A paper on "The Relation between the Refractive Index and the Chemical Characteristics of Oils and Fats" by Messrs. G. F. Pickering and G. E. Cowlishaw was read by the latter. A very large number of determinations on freshly prepared seed oils were averaged, and it was found that the relation between refractive index and iodine value could be expressed by a straight-line graph, in the cases of linseed, soya, cottonseed, and groundnut oils. By introducing corrections for acid value and for low molecular weights the relation had been modified so as to include rapeseed, palmnut and coconut oils. Highly hydroxylated oil like castor oil was not included. The complete equation is

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[3] The process is presumably carried out in a similar manner to that described in the Bergius Patent (Eng. Pat., 1914, 4574) for obtaining light hydrocarbons from heavy oils—a temperature of 400° C., and a pressure of 100 lb. of hydrogen.

$$\text{Ref. Index } 40^\circ\text{C} = 1{\cdot}4643 - 0{\cdot}000066\ (\text{sap. val.}) - 0{\cdot}0096\left(\frac{\text{acid val.}}{\text{sap. val.}}\right) + 0{\cdot}0001171\ (\text{iod. val.})$$

Mr. Pickering in the discussion pointed out that the results of this work were chiefly of value to seed-crushers who could test the oils when freshly made. The equation did not apply to ordinary commercial samples, owing to changes in the oil due to polymerisation and oxidation.

LIVERPOOL.

The following is a short abstract of the paper on "The Effect of Chlorides on the Products of Distillation of Coal," which was read by Mr. A. E. Findley before the Section on November 25, in the Muspratt Lecture Theatre of the University.

Experiments were carried out on a specially washed coal to ascertain the amount of fixation of ammonia at different temperatures by the addition of different chlorides to the coal before distillation.

After describing the experimental procedure, including the method of obtaining gradual distillation and measurement of temperature, etc., the author detailed the yields of ammonium chloride and free ammonia obtained by using (1) sodium chloride, (2) calcium chloride, and (3) magnesium chloride with the coal at temperatures of 650° C., 750° C., and 850° C. It was shown that the maximum yield of ammonia is obtained at 750° C. and that about 77 per cent. of the total ammonia can be recovered as fixed ammonia by the use of calcium chloride. The fact that iron is carried 40 cm. along the tube at temperatures above 750° C. was referred to as evidence of the possibilities of corrosion of fireclay retorts. The similar effect of chloroform was also mentioned. The author then discussed Vivian Lewes's interpretation of Burgess and Wheeler's results on the production of ammonia in the distillation of coal. The object of the paper was to enable fuel technologists to form some idea of the value of recent patents for the addition of chlorides to coal in the carbonising retorts.

On December 3 a dinner was held jointly with the local section of the Institute of Chemistry in the Exchange Station Hotel. Dr. G. C. Clayton, chairman of the Section, presided, and among the guests were the Lord Mayor of Liverpool, Alderman C. H. Rutherford, the Lady Mayoress, Dr. T. G. Adami, vice-chancellor of Liverpool University, Mr. Chaston Chapman and Mr. R. B. Pilcher, Mr. A. Smetham, Alderman Max Muspratt, and the Town Clerk of Liverpool, Mr. G. H. Etherington. The toast of the City of Liverpool was proposed by Mr. Pilcher and acknowledged by the Lord Mayor, and that of the Institute of Chemistry and the Society of Chemical Industry by Dr. Adami, Mr. Chaston Chapman, Mr. Max Muspratt, and Dr. E. F. Armstrong replying thereto.

GLASGOW.

The fourth meeting of the session was held in the Institute of Engineers and Shipbuilders on November 29, Mr. W. E. Moodie presiding. A paper was read by Dr. H. Hepworth on "Some Recent Applications of Magnesium in Synthetic Organic Chemistry."

Dr. Hepworth commenced by giving a brief review of the literature of the organo-metallic compounds of zinc and magnesium leading up to the work of Barbier and his pupil Grignard. He then described the applications of the Grignard reagent to the synthesis of a great variety of organic compounds, many of which are prepared with great difficulty by other methods, and drew attention to the highly interesting compounds containing such elements as phosphorus, arsenic, antimony, and tin in a cyclic hydrocarbon formation which had been synthesised by means of this reagent. By its use, also, many organic compounds of silicon had been prepared, notably an optically-active compound containing an asymmetric silicon atom. The speaker referred to the use of the reagent in determining the structure of organic compounds which exist in keto and enol forms, and of such compounds as diazomethane.

In conclusion the author pointed out that the high cost of materials militated against the general use of the Grignard reagent on an extensive scale, but that for the synthesis of products commanding a high price, such as perfumes, essences, and drugs, it was finding industrial application.

NOTTINGHAM.

The opening meeting of the session was held on November 30; Mr. J. H. Dunford was in the chair, and Messrs. H. Droop Richmond and J. M. Wilkie read a paper on "The Scientific Foundations of Analytical Methods."

The general methods employed—volumetric, gravimetric, and indirect—were reviewed and illustrated by recent practices, especially those initiated by the authors. In acidimetry and alkalimetry a great choice of devices was available, thanks to the modern theory of hydrion and hydroxylion interaction. The titration of the third hydrion of phosphoric acid after formation of an insoluble compound, the treatment of boric acid either as neutral substance or acid, the determination of saccharin in a solution of its salt containing *o*-sulphaminobenzoic acid by previous precipitation with standard acid—all these methods have an intense diagnostic as well as quantitative value.

The authors considered that in gravimetric analysis, in general, each operation of precipitation in solution must be subjected to the most fundamental investigation, a caution fully borne out by their own work on the co-precipitation of lead with iron. The effects of sorption and other phenomena of the colloidal state were apt to disturb confidence. Important information was given concerning quantitative volatilisation by means of hydrochloric acid and sulphuric acid at water-bath temperatures, and attention was called to the value of sulphanilic acid in driving off the weak acids originally present as esters. The retention of volatile substances also came under review, and the use of tribasic calcium phosphate to retain phosphoric acid in residues, and that of silica to retain bismuth oxide, were described. In discussing extraction processes, the authors stated that the immiscible-solvent methods so largely used in alkaloidal determinations were almost wholly empirical, and that determinations of partition coefficients and limiting solubilities were needed.

LONDON.

The December meeting was held at Burlington House, W., on the 5th inst., Mr. E. V. Evans in the chair. A paper entitled "An Autoclave Test for the Grading of Chemical Glassware" was presented by Messrs. W. L. Baillie and F. E. Wilson, of the Royal Arsenal, Woolwich, and Dr. E. Fyleman summarised a contribution on "The Separation of Adherent Oils or Bitumen from Rock."

In the first paper Mr. Baillie described briefly the autoclave—10 in. deep by 6 in. diam.—which the authors had used for submitting small test-pieces of glassware to steam at temperatures rising to 600° C. and at pressures up to 8 atm. Of the various criteria of durability the liberated alkali and the degree of clouding produced were recommended as the most reliable, change in weight and amount of residue left on evaporation being of minor importance. The liberated alkali was titrated with $N/500$ sulphuric acid in presence of iodeosin. Using the two criteria selected, practically exact agreement was found in the grading of the glassware tested, a fact which indicates that all the effects are due to closely related causes. It is preferable to specify the pressure, and not the temperature, to be employed in such tests, as thermometer-readings are seldom reliable. "Hardness" in the flame is closely related to chemical durability and the grading appears to follow the alumina-content of the glass. The favourable effect of alumina on lamp-working properties was confirmed, but the limits of composition for bottle-glass prescribed by Travers and Turner did not apply to the British-made bottles tested, which, moreover, were found to be excellent for lamp-working. Attempts to calculate the relative degree of "hardness" by means of the "flint equivalents," proposed by Staley, proved only moderately successful, and it was found that the nature and amount of the basic and fluxing oxides have to be considered as well as the refractories (silica and alumina). From a brief theoretical consideration of the conditions employed in heating, the authors conclude that the time of heating needed for attaining the desired pressure, the time of exposure at that pressure, and the manner of cooling, should all be specified with exactness.

Dr. Fyleman, in his paper, referred to the large aggregates of sand mixed with bitumen or oil which are awaiting economic exploitation in various parts of the globe. These may be divided into:—(1) Natural deposits of sand mixed with semi-solid bitumen or asphalt, such as the tar-sands of Alberta, which contain 10 to 20 per cent. of bitumen, are 200 ft. thick in places and extend over 100,000 to 200,000 sq. miles, and similar smaller deposits in the United States and elsewhere; (2) artificial deposits of oil-saturated sand-heaps surrounding producing wells in North America and Russia (10 to 20 per cent. of the production of oil in California is lost in this form), also oil-saturated land surrounding gushers, and the final residue of oil left after draining petroliferous sand by the de Chambrier process, which represents 40 per cent. of the original oil-content of the rock. Various methods of exploiting such deposits have been tried, viz., (1) extraction with organic solvents, (2) distillation by retorting or by heaters inserted into bore-holes, and (3) washing with hot or cold water. All these are uneconomic.

The author's process consists in treating the raw material with an aqueous liquid of low surface tension, such as a very dilute solution of soap. In the case of Alberta tar-sands and of many crude petroleums, a solution of sodium carbonate can be employed on account of the organic acids in the oil or bitumen, and the solution can be used repeatedly. A rearrangement of the phases occurs and the oil or bitumen separates leaving clean sand behind. Where a liquid oil is present, the process is carried out in the cold; a bitumen must be liquefied either by working at 80° C. or over, or by adding sufficient mineral oil. In the case of tar-sand, segregation rapidly occurs and after stirring and cooling, the sand can be separated by flushing through a sieve or trommel, leaving bitumen behind.

Experimental demonstrations of the process were given.

During the evening Mr. W. Cullen, hon. assistant-secretary of the Chemical Industry Club, addressed the meeting on behalf of the Club. He stated that it was very desirable to increase the membership from about 700, the present figure, to 1000, so that the financial position might be strengthened and increased facilities offered to members.

MEETINGS OF OTHER SOCIETIES.

THE FARADAY SOCIETY.

At a meeting held in the Rooms of the Chemical Society, London, W., on November 25, Mr. J. N. Greenwood described experiments on the effect of cold work on commercial cadmium. Commercial cadmium recrystallises spontaneously at ordinary temperatures without the application of cold work; this recrystallisation is hastened by deformation, and the author has shown that deformed cadmium anneals itself at ordinary temperature. Deformation at 20° C. softens chill-cast cadmium, which softens further as it recrystallises. It is suggested that two different forms of cadmium exist, and that the quick cooling by chill-casting suppresses the transformation of the one form into the other. Hardness experiments indicate that allotropic change occurs at about 60° C., which accords with Cohen's transformation $Cd_\alpha \rightarrow Cd_\beta$ The results support the view that the change from Cd_α to Cd_β takes place gradually, the two forms being mutually soluble until a certain critical state is reached, when recrystallisation takes place in the stable form Cd_α appears to be stable between 20° C. and 60°—65° C., and Cd_β between 65° C. and 140° C., beyond which no observations were made. Indications of a third modification were also found.

A paper by Mr. F. H. Jeffery described experiments on the electrolysis of aqueous solutions of alkaline nitrites with a lead anode, and an electrometric determination of the constitution of the complex anion formed. With small quantities of lead in alkali nitrite solutions the existence of a plumbo-nitrite complex $(Pb(NO_2)_4)''$ is established; anode potential measurements suggest that this is the only complex formed. No sodium salt of this anion could be obtained from solutions of different strengths; in some cases $Pb(No_2)_2.H_2O$ separated and in other cases $NaNO_2$ was found to be the stable solid phase. The colour of the solid lead nitrite crystals suggested that the $[Pb(NO_2)_4]$ group might preserve its identity in this solid. From aqueous solutions containing K, NO_3, NO_2 and the plumbo-nitrite complex, a homogeneous solid was obtained, whose composition was not constant. It is probably a solid solution.

Messrs. N. R. Dhar and N. N. Mittra presented a paper on induced reactions and negative catalysis. A large number of "induced reactions," *i.e.*, reactions which do not normally occur except in the presence of an "inductor" which can itself react with one of the substances, have been studied, and it is concluded that the phenomenon is of very general occurrence. Evidence is given to support the view that a chemical change will promote or induce another chemical change of the same nature. The phenomenon of negative catalysis was studied in the case of certain oxidation reactions, in which the catalyst itself is liable to be readily oxidised. It was concluded that intermediate compounds are formed.

Dr. J. N. Pring and Mr. E. O. Ransome have studied the reaction between cathodic hydrogen and nitrogen at high pressure, and found that there are no indications of direct combination at pressures from 1 to 500 atmospheres. They conclude that the powerful reducing effects of hydrogen under conditions of high over-voltage are caused by ionic interchanges rather than through secondary chemical reaction with free hydrogen. The inertness of nitrogen may be attributed to absence of ionisation at low temperatures. The results are also in accord with the view that the transition from hydrogen ions to gas, under high pressure, takes place inside the metal.

Experiments with benzene emulsions containing gelatin as a stabiliser were described by Mr. T. C.

Nugent. Caustic soda causes separation of such an emulsion, but it was observed that the separation is delayed if the emulsion be left undisturbed for some time before the caustic soda solution is added. The author explains this "inhibition period" on the assumption that protecting layers of gelatin are formed gradually round the benzene particles.

ROYAL SOCIETY OF ARTS.

On November 30 Mr. Noel Heaton read an informative and critical paper on "The Preservation of Stone."

After classifying the common building-stones in the order of their durability, Mr. Heaton discussed their decay by natural causes, such as weathering and the growth of vegetation, and by the action of sulphuric and sulphurous acids contained in the air of towns, remarking also on the effect of faulty construction. He then considered the prevention of decay in new buildings and in old, and specified the properties demanded of an ideal preservative. Preservatives were classified into (*a*) those which act only as superficial coatings, (*b*) those which impregnate the stone without chemical action, and (*c*) those which react chemically with the stone, and examples of each of these types were discussed, particular attention being paid to the use of fluosilicates (*cf.* J., 1918, 118 T). The author's views on the various processes were concisely summarised at the end of the paper, as follows:—

1. New work can be rendered to a certain extent more resistant to decay by treatment with fluosilicates, provided the strength of solution and method of application be adjusted to suit the stone used. 2. No preservative treatment will be effective on faulty or face-bedded stones. 3. Constructional methods of reducing decay (prevention of damp, effective carrying away of storm water, etc.), are more important than preservative treatment. 4. For outside work on old buildings, no preservative at present known will preserve decayed stone for more than a limited period. The most economical treatment is dressing with soft soap and alum, renewed every few years. 5. In interiors, where the stone has been corroded by sulphur compounds, baryta treatment is, in many cases, beneficial, but it should only be used with restraint and under careful supervision, and should be followed by distempering. 6. Preservative treatment should only be employed where it is certain that it can, at the worst, do no harm. For this reason articles of unknown composition should be avoided, and only materials used whose action is well understood.

THE CHEMICAL SOCIETY.

At an ordinary scientific meeting, held on December 1, Prof. J. F. Thorpe presiding, the following papers were read:—(1) "Some Researches on the Metallic Carbonyls": R. Mond and A. Wallis. (2) "The Action of Nitric Oxide on the Metallic Carbonyls": R. Mond and A. Wallis. (3) "The Chemistry of Polycyclic Structures in Relation to their Homocyclic Unsaturated Isomerides. Pt. II. Intra-annular Tautomerism": E. H. Farmer, C. K. Ingold and J. F. Thorpe. (4) "Constituents of the Leaves of *Acer Ginnala*": A. G. Perkin and Y. Uyeda. (5) "The Velocity of Decomposition of High Explosives in a Vacuum. Pt. III. Mercuric Fulminate": R. C. Farmer.

The first two papers, read as one, described new carbonyls of molybdenum and ruthenium. The latter metal was found to yield two of these compounds, of which the dicarbonyl is unique in that it is soluble in water. The optimum temperature in the preparation of iron carbonyl $Fe(CO)_5$, a compound which the late Dr. Ludwig Mond found great difficulty in preparing, was found to be 200° C. and the yields were studied at 100, 200 and 300 atmospheres pressure.

No combination of carbonyls with other substances has been known hitherto, but some evidence has been obtained of union with nitric oxide. In cobalt carbonyl, $Co(CO)_4$, the fourth CO-group is only feebly held in the molecule; when this is lost, the tricarbonyl, $Co(CO)_3$, unites with one NO-group giving a cherry-red liquid. The preparation of carbonyls, except nickel carbonyl, was found to be attended with great experimental difficulties.

Prof. A. G. Perkin described the chemistry of extraction of the leaves of *Acer ginnala*. A plant has been set up by the Japanese for this purpose in Korea. Acer tannin, a substance resembling gallol tannin, is produced; unlike the latter, however, it will not tan leather. The technical value of the process lies in the fact that an excellent dye is attained.

Dr. R. C. Farmer exhibited curves showing the rate at which the decomposition of mercury fulminate proceeds *in vacuo* at various temperatures below 80° C., *i.e.*, below the possible temperature of explosion. The gaseous product of decomposition was found to be carbon dioxide. A quiescent or induction period of 80 hours was shown in the case of brown fulminate and of 140 hours in the case of the white fulminate. After that time, no doubt due to the production of some catalyst, not initially present, decomposition set in rapidly and at a constant rate. During the period of decomposition the rate could be retarded by extraction with water showing that the catalyst had been dissolved out.

In discussion Sir Robert Robertson alluded to the importance of this work from the point of view of storage, and pointed out that this decomposition explained why fulminate was sometimes found to be "dead," *i.e.*, useless as a detonator.

SOCIETY OF PUBLIC ANALYSTS.

An ordinary meeting was held at Burlington House, W., on December 7, Mr. A. Smetham, president, in the chair.

Mr. B. S. Evans, in a paper on "The Estimation of Small Quantities of Antimony in Copper and Brass," described a method which he claims to be reasonably rapid and accurate. The process consists, briefly, in eliminating the copper with sodium hypophosphite, precipitating the antimony on copper foil, and after re-solution, precipitating it as sulphide and estimating colorimetrically.

"The Inks of Ancient and Modern Egypt" was the subject of a paper by Mr. A. Lucas, who described black and coloured inks on ancient papyri and parchments and their chemical reactions. An analysis was given of a carbon ink dating from the 16th century B.C., and in describing the inks in old Arabic and Coptic books evidence was adduced of the use of iron inks in the 7th century B.C. The composition and characteristics of modern Egyptian inks were then outlined, and analyses given of different qualities of carbon inks. Lastly, the brown discoloration of ancient carbon inks in MSS. and books was discussed and explained.

Mr. C. L. Claremont presented "Notes on the Analysis and Use of Red Squill in Rat Poisons." In this paper the author gives analyses and toxic values of a number of red squill powders, the main feature of which is the presence of a sugar-like substance which serves as an indication of the presence of squill, but which is apparently not related to the toxic value. Approximate analyses of white squill (B.P.) and *Urginea Burkei* were also given, and the difficulty of distinguishing red from white squill discussed. The paper also contains analyses of liquid extracts of squill and other rat poisons containing squill, and experiments relating to the best method of making squill preparations (*cf.* J., 1921, 327 R).

NEWS AND NOTES

UNITED STATES.

Fire-resisting Shelving.—In a recent fire which caused extensive damage in the Chemistry Building of Tulane University, some attic shelves which had been treated ten years previously with aniline hydrochloride and copper sulphate were not even scorched, but brass situated within three feet of these shelves, which were within ten feet of the source of the fire, was melted.

The Metric System in Chemical Industry.—The Division of Industrial and Engineering Chemistry of the American Chemical Society, at its last meeting, declared itself unanimously in favour of having pure chemicals supplied by manufacturers in metric units and only in standard packages. Efforts are being made to induce all chemical manufacturers to insist upon having their orders executed and invoiced in metric units.

"Anthracoal."—A new domestic and metallurgical fuel called "anthracoal" has been produced by mixing small particles of anthracite and a matrix of practically pure carbon formed from the distillation of coal-tar pitch or other suitable bitumen. "Anthracoal" can be made in a coke oven upon the same large scale as bituminous coke and with little more expense, as anthracite culm can be used in its manufacture. The content of pitch varies, but in experimental tests 14·8 to 25 per cent., with m. pt. 265°—280° F. has been found satisfactory. On an eight-day kitchen-range test the best "anthracoal" wos found to be 20 per cent. more efficient than anthracite coal of chestnut size.

"Chemical Literature and Its Use" is the title of a pamphlet (second edition) by Marion E. Sparkes, Library Assistant in Chemistry at the University of Illinois, containing notes of a course of 16 lectures given to third-year students who have a reading knowledge of French and German. The first four lectures treat of the method of handling the literature adopted by the librarian, the following eleven deal with the literature relating to the various branches of chemistry, and the final lecture contains suggestions upon searching all the literature for a given topic. The bibliography appended includes "Some Papers upon Chemical Literature, Its Value and Utilisation."

A careful perusal of the pamphlet leaves the impression that the chemistry students of Illinois University are, indeed, fortunate in having the opportunity of attending this course of lectures, and as a result they should certainly be able to find any information they require in the University Library or in libraries associated with it. Students of chemistry everywhere will find the pamphlet very useful for the purpose of reference, since the publications mentioned are in general use where they are available. The absence of systematic instruction in the consultation of chemical literature is a fault of academic training which should be remedied. The process by which the chemist becomes familiar with the literature is comparatively lengthy, and circumstances may conspire to keep below his horizon publications which would prove of great value to him; a little systematic training, such as is outlined in the pamphlet, together with some instruction in indexing, would eventually save him much time and minimise the possibility of such undesirable incidents. The pamphlet may be obtained from the author at Urbana, Illinois, for one dollar, post paid.

Phosphate Rock in 1920.—The phosphate rock sold in the United States in 1920 amounted to 4,103,982 long tons, valued at $25,079,527, an increase in quantity of 80 per cent. and in value of 116 per cent. as compared with 1919. The quantity actually mined, however, was 3,975,001 t., an increase of 115 per cent. Production in Florida more than doubled, and all the other producing States, except S. Carolina and Wyoming, showed an increased output. The improvement noted in the export trade in 1919 continued, and in 1920 1,069,712 t. was exported, mainly to northern Europe, Spain and Portugal (*cf.* J., 1921, 194 R).—(*U.S. Geol. Surv.*, *Aug.* 11, 1921.)

The Uses of Slate Flour.—From 80 to 95 per cent. of the gross production of the slate quarries in the United States has been discarded as waste, and the expense of handling so much unsaleable material has added to the cost of finished slate. Numerous uses for the waste have been discovered by the U.S. Bureau of Mines working in conjunction with manufacturers of mechanical rubber goods. Thus powdered slate or slate flour can be used as a filler to give "body" or impart resistance to wear to hose-pipe, rubber heels and soles, tyres and packing, as well as linoleum, oilcloth, etc. It is already extensively employed as a filler for road asphalt, tarred roofing and flooring. In these new fields pulverised slate will have to compete with well-known fillers, such as talc, china clay, limestone, barytes, etc., but its low price will give it a great advantage.—(*Oil, Paint and Drug Rep.*, *Oct.* 10, 1921.)

CANADA.

The Mining Industry in British Columbia.—The unsatisfactory state of the metal markets has had a marked influence upon the mineral production of British Columbia, and many mines have been closed down during the present year. The value of the gold production for the year 1921 will approximate to $3,000,000, chiefly derived from the Rossland district, and Surf Inlet, Princess Royal Island. There has been a great decrease in the production of silver, owing to the closing of the Dolly Varden and many of the Slocan mines.

The copper output for this year, based upon figures to date, should be about 14,300 long tons, the greater portion being from the Hidden Creek mine of the Granby Company. The Canadian Pacific Railway is repairing the Copper Mountain branch of the Kettle Valley Railway, preparatory to operations being resumed at the mine of the Canadian Copper Corporation, near Princeton, which has very large reserves of low-grade copper ore. The Trail smelter is chiefly dependent upon this mine for its supply of copper ore. It has not operated since last winter. About $5,000,000 has been expended on construction of a concentrating mill, equipment and development, another half million dollars upon hydro-electric power supply by the West Kootenay Power and Light Company, and $2,000,000 by the C.P.R. in constructing a line connecting the mine with Princeton. It is quite probable that the Consolidated Mining and Smelting Co., which is interested, may operate the mine. The present capacity of the developed mines and smelters of British Columbia is 33,500 long tons of ingot copper per annum, which can, taking into consideration projected undertakings, be increased to double that quantity in a few years.

The lead production will probably be the highest which the province has had in the past twenty years. It is nearly all from the Sullivan Mine at Kimberley, East Kootenay, the property of the Consolidated Mining and Smelting Co. The ore body of this mine consists of a quartzite containing blende and argentiferous galena. From this mine comes the greater portion of the zinc production of British Columbia, which is refined electrolytically at Trail, and will be approximately 22,300 t. for the current year.

Although there has been much prospecting and many finds have been made during the year, no important new developments have been undertaken owing to the condition of the money market.

Miscellanea.—Gas has been struck in the Imperial Oil Company's drilling at Pouce Coupe, N.W. Alberta.

The Feldspar Glass Co., Ltd., of Canada, is erecting a factory at Oshawa, Ontario, for the manufacture of high-grade glass and by-products.

The cyanamide plant of the American Cyanamid Co. at Niagara Falls, Ontario, is only producing on the basis of approximately 20 per cent. its capacity.

The maple sugar production in Quebec has increased threefold in the past three years and now amounts to 20 million lb. annually, valued at $7,000,000.

The Dominion Development Corporation, with a capital of $3,000,000, has been incorporated to develop the wool-combing industry. Canada possesses no wool-combing plant.

The Eugene F. Phillips Electrical Works, Ltd., which manufactures copper electric wire, is to erect a plant at Brockville, Ontario, at a cost of $3,000,000, and employ 600 hands.

The plant of the Triangle Chemical Co. of British Columbia, at New Westminster, is nearing completion. The manufacture of sulphuric acid, by the chamber process, will commence early in November. The company will manufacture fertilisers.

An English syndicate has purchased the Kingston gold mine in West Shining Tree district of Northern Ontario, and development will be pushed forward energetically. The Mond Nickel Co. and the Hollinger Gold Mines have invaded this camp; the latter company has purchased thirteen claims and has two drills at work. The net profit of Hollinger Consolidated Gold Mines is the highest in the history of the company, and the dividends for the year 1921 will total 13 per cent., amounting to $3,126,000. The company proposes to sink a very large central shaft on its Porcupine property.

SOUTH AFRICA.

The Paper Industry.—The manufacture of wrapping paper from spent wattle tan is to be undertaken by the S. African Paper Mills, Ltd., a new company with a capital of £200,000, which has been formed by the Albert Falls Power Co., Ltd., of Pietermaritzburg, Natal. The production of newsprint paper from wattle wood is being investigated.

Prior to 1920 there were no paper mills in the country (*cf.* J., 1921, 292 R). Imports of wrapping paper in 1920 amounted to 3499 tons, valued at £267,825, of which the United Kingdom supplied 34·3, Canada 28·7, Sweden 18, and the United States 7·8 per cent. It is unlikely that the local product will be able to supplant the imported material for some time.—(*U.S. Com. Rep.*, *Oct.* 10, 1921.)

AUSTRALIA.

Mineral Resources of the Northern Territory.—The Northern Territory is exceptionally rich in minerals, but as yet only the strip along the north of the Territory has been exploited, and the vast mineral area in the centre of Australia, covering over 200,000 sq. miles, must remain unworked until railway communication is available. The Government is now offering assistance to the mining industry in various ways. Up to June, 1920, the total value of the gold output was £2,214,442, compared with £1,052,163 for all other minerals. Since 1894 the production has declined owing to difficulties in the transition from alluvial to reef mining and to the lack of systematic attempts to prove the properties in depth. The yield of tin, from the Maranboy field, near the Katherine railhead, and of wolfram, from the Hatches Creek and Wauchope fields, has remained steady. Other minerals found in the Territory include silver, silver-lead ore, copper ore, lignite, and mica. There are no definite proofs of the existence of petroleum, but oil leases are again being applied for (*cf.* J., 1921, 111 R; 1921, 69 R).—(*Bd. of Trade J.*, *Oct.* 27, 1921.)

JAPAN.

The Oxygen Industry.—Production of oxygen on an industrial scale dates back to 1910, when the Nippon Sanso Kabushiki Kwaisha (Japanese Oxygen Co.) started the manufacture in Tokyo, using the Linde process. The industry made great progress during the war and in 1920 there were 20 companies and 27 factories, with 8 more companies in contemplation and 8 new factories under construction. The air-liquefaction process is used in 18 factories, ten employing the Linde and five the Claude process; electrolytic oxygen is made in 10 works and both methods are used in one. Invested capital amounts to 6·61 million yen (about £674,000 at par) and there are 381 employees. The annual capacity and production in 1918 and 1919 are given below in thousands of cubic metres:—

	Capacity.	Production.		Quality.
		1918.	1919.	
By air-liquefaction	3,484·8	816	1,405	97%
Electrolytic	1,531·5	529	714·5	99%
Totals	5,016·3	1,345	2,119·5	

FRANCE.

Industrial Notes.—*Chemical Industry.*—The Senate has ratified the Bill passed by the Chamber of Deputies leasing the Lannemezan factory to the Société des Produits Azotés. This factory was erected by the Ministry of Munitions during the war for the production of carbide, cyanamide, and nitric acid, but was not completed owing to the conclusion of the armistice. It is understood that the Société des Produits Azotés will not only complete the factory but will utilise local water-power as a source of energy.

In the chemical market the shortage of ammonia and ammonium sulphate is expected to increase; and in view of the cheap synthetic products available, difficulty is anticipated in disposing of the large stocks of natural perfumes. In the sugar industry the superior equipment and capacity of the factories and the larger area under sugar-beet are expected to compensate for the decreased yield and poor quality of the juice. The world's production of sugar in 1921 is estimated at 15,620,000 metric tons, compared with 16,555,059 t. in 1920.

Metallurgy. — Business in heavy metallurgical products is undoubtedly reviving and more blast furnaces are being blown in. Compared with the pre-war total of 220 blast furnaces, 91 were working on January 1, 1921, 72 on July 1, and 51 on October 1. Stocks of pig iron are small, and important consignments have been exported to Germany, England, Holland, Brazil, and Argentina, at prices varying between 200 and 210 francs per metric ton. Semi-finished steel is quoted at 320—370 fr., ex Lorraine works. In the three months, July to September, 1921, the output of iron ore was 3,045,415 t., of pig iron 764,915 t., and of steel 691,088 t. The output of steel improved a little but that of iron ore and pig iron declined. The Syndicate of Iron Founders of France will probably change its name into Le Syndicat des Fondeurs de France in view of the fact that founders of steel, aluminium, copper, and brass are to be admitted into its ranks.

Coal.—Owing to the decreased demand for industrial and domestic coal, and to keen competition between British, German (indemnity), and Saar coal, stocks of coal continue to accumulate; in the

Nord and Pas-de-Calais departments they rose from 727,000 t. on October 1 to 800,000 t. on November 1. In October the pits in the invaded areas produced 564,151 t., or 25,998 t. more than in September. The production of coke in the former month was 9164 t. (5793 t. in September) and that of briquettes 92,166 t. (91,335 t.). It is proposed to establish a "Comptoir" for the purchase and sale of metallurgical coke which shall be in direct touch with the consuming industries and independent of State control. According to the scheme, the Comptoir would be the sole purchaser of all the available metallurgical coke, whether French or German, and also the exclusive seller to the proprietors of blast furnaces and foundries.

GENERAL.

The Pharmacy Acts Amendment Bill and the Institute of Chemistry.—The Registrar of the Institute of Chemistry has addressed a letter to Capt. J. O'Grady and to the two supporters of his Bill (*cf.* J., 1921, 437 R) stating, *inter alia*, that the Council of the Institute was not consulted concerning its provisions and had no knowledge of its promotion. The Council deplores the application of the term "chemist" to two distinct callings and would welcome any legislation tending to remove the confusion which results therefrom; by using the distinctive titles "chemist" and "pharmacist" to denote these callings such confusion, which exists in no other country, would tend to disappear. The Council also dissociates itself from the suggestion that it should be represented on a central council whose functions would include those now vested in the Pharmaceutical Society of Great Britain.

The Use of White Lead in Painting.—A convention was adopted at the third session of the International Labour Conference, held recently in Geneva, by which the use of white lead and related pigments for internal painting will be barred after the lapse of six years. Exceptions are made in the case of railway stations and certain industrial establishments, artistic painting, fine lining, and of white pigments containing not more than 2 per cent. of lead, expressed as metal. It was also agreed that after six years no males under 18 years of age, or females, shall be employed for industrial painting with white lead, lead sulphate, or products containing them; but this proscription shall not apply to apprentices. From January 1, 1924, these pigments are only to be used in paste form, or ready prepared, and measures are to be taken to prevent danger from their application in the form of spray, and danger due to dust formed in rubbing down or scraping. From that date also, safeguards relating to personal hygiene and medical supervision are to be introduced to minimise the incidence of lead poisoning.

The Composition of Insecticides and Fungicides.—The introduction into Parliament of the Bill to regulate the trade in certain of the chemicals in general use for the control of disease and pests, so that materials of guaranteed composition may be made available to users, having been postponed, the Ministry of Agriculture has published (J., Min. Agric., Oct., 1921) its chief provisions for the information of manufacturers and the public. These provisions include the following:—

Lead Arsenate Paste, as sold, shall contain not less than 14 per cent. total arsenic oxide (As_2O_5) (or 28 per cent. after drying at 100° C.), not more than 0·5 per cent. of water-soluble arsenic or 3 per cent. of substance other than lead arsenate and water.

Lime-Sulphur shall be made from lime, sulphur, and water only; the solution shall have minimum sp.-gr. 1·3 at 15° C., shall be free from suspended matter, and remain clear at all dilutions.

Nicotine.—The seller should state if the article contains free or combined nicotine, and the percentage of each.

Copper Sulphate sold for spraying shall contain at least 98 per cent. of the crystallised compound.

Soft Soaps.—Not less than 95 per cent. of the total alkali content shall consist of potash, and packages shall bear on the label the percentage content of fatty acids and resinous acids.

Liver of Sulphur must consist of a mixture of salts of potassium, chiefly sulphides, conform to the requirements laid down for sulphurated potash in the British Pharmacopœia for 1914, and contain from 42 to 45 per cent. of sulphur.

Cyanides.—Sodium and potassium cyanides sold for agricultural and horticultural use shall evolve not less than 56 and 43.7 per cent. by weight, respectively, of hydrogen cyanide when treated with acid.

Formaldyhyde is not yet within the scope of proposed legislation. In whatever form it be sold, the percentage content of formaldehyde in the solution should be guaranteed.

The Explosion at Oppau.—The work of clearing up the *débris* is proceeding quickly, and a large proportion of the 7000 tons of ammonium sulphonitrate that was unaffected by the explosion has been removed without accident. It is still affirmed that the explosion was due to blasting the hardened salts, but no scientific explanation of the detonation has yet been advanced, in spite of active investigations carried out on the spot by four commissions of experts. The view that there was only one explosion, and not two, is gaining ground, and the first observed violent detonation is ascribed to quickly-spreading earth-tremors. The part of the works that was least damaged has been so far repaired that a considerable proportion of the manufacture, notably the production of ammonia, was due to be resumed on November 1. "Ammonsulfatsalpeter" is not to be manufactured in future (*cf.* J., 1921, 381 R).—(*Chem.-Z., Nov.* 19, 1921.)

The Artificial Silk Industry in Belgium.—It is announced that the Tubize company is now working at full capacity and is producing 4500 kg. of artificial silk a day at a satisfactory profit. The largest part of the output is exported to Germany and the remainder to France and America. The company has appealed successfully against the adverse judgment given in the action for breach of contract brought against it by the Belgian Viscose Co.—(*Chem. Ind., Sept.* 5, 1921.)

The Belgian Glass Industry.—Over one-quarter of the 12,000 workers employed in the Belgian glass industry is unemployed, and the number would be greater had not the available business been distributed among the factories to secure a minimum of total unemployment. Bottle and flint-glass plants are working one-quarter time and stocking 50 per cent. of the output. Only three tank-furnaces are working in the window-glass plants, but stocks are being reduced owing to the increased trade with North and South America and the Far East. Several additional furnaces may shortly be used. Difficulty is felt in competing with German manufacturers who undercut Belgian prices by from 25 to 40 per cent. A new company has been recently formed to hold the exclusive European rights of the Libby-Owens patents, and another company, the Verreries Méchaniques de Charleroi, has just been founded with a capital of 2·5 million francs to work the Fourcault process in a vacant factory at Montignies-sur-Sambre. The latter company has been formed by interests connected with the Verreries de Dampremy, which holds the Fourcault process patents covering the manufacture of 5 million ft. per annum, but which has never produced to the extent of its rights.—(*U.S. Com. Rep., Oct.* 10, 1921.)

The outlook is now brighter and orders are arriving in large numbers from every quarter. Operations have been started at the glassworks of Jumet and de Binche.—(*Times Tr. Suppl., Dec.* 3, 1921.)

The Salters' Institute of Industrial Chemistry has awarded forty-seven grants in aid to chemical assistants, occupied in factory or other laboratories in or near London, to facilitate their further studies.

Safeguarding of Industries Act.—On December 10 the official referee ruled that mechanical compounds of thorium and cerium nitrates or oxides in the form of mantles or parts of mantles used in incandescent gas-lighting, shall be chargeable with duty under Part I of the Act; and that santonin be removed from the list of dutiable articles because it is not produced by a process of manufacture or used for subsequent chemical actions.

PERSONALIA.

Messrs. Huntley and Palmers, Ltd., have offered the sum of £10,000 to the University College, Reading, for the purpose of agricultural research, provided the college obtain a university charter.

Prof. L. A. Olney, professor of chemistry and dyeing in the Lowell Textile School, Massachusetts, and a member of this Society since 1904, has been elected president of the American Association of Textile Chemists.

At the 259th anniversary meeting of the Royal Society, held on December 30, Prof. C. S. Sherrington was re-elected president, the present treasurer and secretaries were also re-elected, and the following, among others, were elected members of council:—Sir W. Bragg, Prof. A. W. Crossley, Dr. H. H. Dale, and Prof. A. Harden.

The French Academy of Sciences has awarded to M. Georges Claude the Prix le Conte for his distinguished work in chemistry and physics and its practical applications to industry. M. Claude has declined to accept the award, which is of the value of 50,000 francs, and has requested the Academy to distribute the money equally between the Société de Secours des Amis des Sciences and the research laboratories of the Collège de France.

Prof. A. Kötz has been appointed director of the Institute for Chemical Technology in Göttingen.

A monument to Emil Fischer, the gift of the German dye industry, was unveiled in the Luisenplatz, Berlin, on November 25.

A mural tablet to the memory of the late Lord Rayleigh was unveiled in Westminster Abbey by Sir J. J. Thomson on November 30.

On November 24, Field-Marshal Earl Haig unveiled memorials to the members of the Institution of Mining and Metallurgy and of the Institution of Mining Engineers who fell during the war, in the new home of these institutions, Cleveland House, City Road, London, N.

The death is announced of Mr. F. A. Lane, aged 49 years, who as manager of the Kalbfleisch Corporation at Erie, Pa., did important work in perfecting the gas-mask used by the American troops during the war.

The death, at the age of 78 years, is announced of Wilhelm Eitner, head of the Research Institute for the Leather Industry in Vienna, and brother of Prof. Ignaz Eitner, with whom he shared the management of the journal *Der Gerber.*

REPORTS.

Report on the Conditions and Prospects of British Trade in Canada, Dated August, 1921. *By* Capt. E. J. Edwards, *H.M. Senior Trade Commissioner in Canada and Newfoundland. Pp.* 73. *Department of Overseas Trade. London: H.M. Stationery Office.* 1921. *Price* 2*s.* 3*d.*

Trade in Canada has been stagnating during the past twelve months, but there are signs of a very slow revival. As is well-known, the import trade with the United Kingdom is very small indeed compared with that with the United States, therefore the increasing tendency to purchase from the former rather than from foreign countries is very satisfactory. In view of this attitude, and of the favourable preferential tariff, United Kingdom manufacturers are urged to make immediate and strenuous efforts to gain a far larger share of Canadian trade. The importance of Canada as a market for British chemicals was discussed recently in these columns (*cf.* J., 1921, 285 R); the number of orders for chemical products placed in the United Kingdom is believed to have considerably increased during the past year, and it is held that the number would have been materially greater but for slow deliveries and high prices. The undesirable practice of conducting business through a single agent for the United States and Canada is declining (*cf.* J., 1920, 136 R), but there is need of more care in the choice of agents, and much more attention should be given to advertising. Home manufacturers of scientific apparatus, plant, and books should consider the possibility of trade through the educational institutions of the Dominion.

The report touches upon nearly every branch of commercial activity, including drugs and chemicals, dyes, soaps, paints, and varnishes, metal products, earthenware, rubber goods, linoleum, leather, and scientific apparatus. German competition is being felt in heavy and pharmaceutical chemicals, but the new import duties on goods from countries with depreciated currencies should hinder expansion in this direction. Although imports of British dyes increased during the year, the bulk of the trade went to the United States. In the year ended March, 1921, imports of soaps were valued at $1,424,000, of which the share of the United States was $1,245,000, and that of the United Kingdom less than $104,000. There is a good potential market for the smaller rubber manufactures and for paints of the highest quality.

General Report on the Commercial, Industrial, and Economic Situation of China, Dated June, 1921. *By* H. H. Fox, *Commercial Counsellor, and* H. J. Brett, *Commercial Secretary, H.M. Legation, Peking. Pp.* 64. *Department of Overseas Trade. London: H.M. Stationery Office.* 1921. *Price* 1*s.* 9*d.*

Foreign Trade in 1920.—Although China has participated in the general commercial depression, and has also suffered from grave political unrest, the total value of the country's foreign trade, viz., £442,786,435, beat all previous records, the decline in value of such staple exports as beans and bean-cake, vegetable oils and seeds, being more than offset by the increased import-values of cotton goods, iron, steel and other metals, machinery, dyes, colours and paints, kerosene, sugar, and tobacco. The balance of trade was thus distinctly adverse. In spite of this it is held that the country is on the eve of a period of unexampled commercial and industrial development; the potential wealth remains enormous, production of raw materials is steadily increasing, and manufacture of goods formerly imported has begun.

Imports in 1920 were valued at £258,847,474, and were mainly derived from the British Empire (48·5%), Japan and Korea (33%), and the United States (19·9%). Great Britain supplied 18·1 per cent., and probably 20 of the 21·9 per cent. derived from Hongkong was of British origin. Among the chief articles imported were:— Copper ingots and slabs 24,797 long tons; iron and steel 256,014 t.; tin, block, 3102 t.; tinplate 35,071 t.; other metals and minerals £5,265,500; dyes, colours, paints 42,156 t.; medicines £2,305,800; sugar 244,543 t.; glass £1,599,600; matches and materials for £1,650,300; leather, etc. £2,433,600.

Dyestuffs.—Supplies of synthetic indigo were very short in the early part of 1920, but the resulting high prices led to large importations and low prices, and present stocks are estimated to last from 6 to 18 months. The estimated average price of synthetic indigo during 1920 was 6s.—7s. per lb., but in June, 1921, it had dropped by about 28 per-cent. from this figure. It is considered improbable that the production of natural indigo will be curtailed unless the price of foreign indigotin falls to about 40 Hk. taels per picul (2s. per lb., with the Haikwan tael at 6s. 9½d.). Germany supplied 29 per cent. of the synthetic product imported in 1920, and is doing its utmost to regain control. There are large stocks of German indigo in the country and business is done through Dutch firms or through the original Chinese agents. Several new American brands have been marketed, but they have not met with much success; the French and Swiss products sell readily. British synthetic indigo is held to be equal to any of the well-known Swiss or German brands, and provided the price be kept down it will obtain a fair share of the market.

The market is also overstocked with coal-tar dyes, very large quantities having been imported from Germany. Imports from Great Britain in 1920 were small, owing to the difficulty in obtaining export licences; their quality is good but the prices are too high.

In the following analysis of recent importations of dyes, the picul is taken at 133⅓ lb., and the value of the Haikwan tael at 6s. 9½d. (average value for 1920):—

Importations of Dyestuffs.

	1920.	1921. Jan.—May
	Long tons.	
Indigo:—		
Switzerland	1,092	775
United States	2,325	780
France	1,117	769
Germany	2,644	749
Japan	49	nil.
United Kingdom	449	517
Coal-tar dyes:—	£'s sterling.	
Switzerland	125,200	22,791
United States	530,550	116,460
France	(very small)	
Germany	766,010	600,880
Japan	234,670	55,603
United Kingdom	94,183	39,876

Exports from China in 1920 amounted in value to £183,928,962, and included:—Iron, pig, 182,470 long tons; ores, iron, etc. 715,050 t.; tin, block, 11,306 t.; albumin and egg-yolk 25,191 t.; fibres 20,138 t.; groundnuts 75,481 t.; oils, vegetable and essential, 193,870 t.; seeds, including sesamum, 222,110 t.; tallow 10,433 t.; and skins and hides 18,529,981 pieces. British goods have a first-class reputation in China, but the trade suffers from high prices and delays in delivery, defects which require remedy in face of increasing American competition.

Industries.—The obstacles to industrial development that were noted in the last report (*cf.* J., 1920, 326 R) still remain, but are less serious. Communications are slowly improving and modern factories are springing up throughout the country. The more important industrial enterprises include cotton, silk, bean, flour, and paper mills; match, glass, soap and candle, and albumin factories; engineering, shipbuilding, iron and cement works; beet and cane sugar, rubber, and paint are among the industries recently established. The estimated production of coal in 1920 was approximately 20 million tons, or 25 per cent. more than in 1916; reserves are estimated at 45,000 million tons by the Chinese Geological Survey. Statistics of the output of iron ore are not available, but there has been a slight improvement since 1916, when 1,338,520 t. was mined. The ironworks, including those to be erected, will consume about 3 million t. of ore yearly, and the reserves of iron ore are estimated to be 1000 million tons. Other important minerals are ores of antimony, tungsten, zinc, lead, and tin, but although there is no market for these at present it is believed that in future China will supply an increasing proportion of the world's requirements of these metals.

LEGAL INTELLIGENCE.

THE QUALITY OF ASPIRIN TABLETS. *Western Tablet Co., Ltd. v. Bennison, Ltd., Chelsea.*

On November 17 Judge H. M. Sturgis heard two actions in the West London County Court brought by the Western Tablet Co., Ltd. against Bennison, Ltd., Chelsea, for payment for two consignments of tablets supplied under contract as "compressed tablets of aspirin, 5 grains." The defendant company refused payment on the ground that the tablets did not contain pure aspirin or the 5 grains of aspirin stipulated.

Mr. E. J. Parry stated that he had received from the plaintiff company two samples of aspirin tablets marked with the defendants' name, which he had analysed and found to contain an average weight of 5·1 grains of aspirin, the average weight of the tablet being 6 gr.; they also contained small amounts of starch, siliceous matter—obviously talc —and a substance he could not identify, but which apparently showed a trace of gum. Free salicylic acid was present in the tablets, one containing 0·3 per cent. and the other 0·27 per cent. He thought that freshly-made tablets would usually contain about 0·2 per cent. of free salicylic acid, and that this would increase on keeping up to 0·7 or even 1 per cent., according to the conditions of storage. He had never found any aspirin tablets that did not contain a small proportion of salicylic acid. There was no formula and no standard in the British Pharmacopœia for aspirin tablets, but the pure drug as there specified should contain no free salicylic acid. The results of his tests were quite consistent with the manufacture of the tablets in accordance with the formula of the British Pharmaceutical Codex.

Mr. W. Russell Smith deposed that he had analysed the tablets supplied to Bennison, Ltd. by the plaintiff company, and had found an average content of 4·77 gr. pure acetylsalicylic acid, 0·05 gr. free salicylic acid, 0·1 gr. moisture, and 1·13 gr. starch, the average weight of each tablet being 6·05 gr. He thought a standard content of 0·2 per cent. of free salicylic acid in an aspirin tablet reasonable; he had found 0·85 and 0·95 per cent., respectively, in the samples sent to him. He agreed that aspirin tablets were better when freshly-made than when kept for some months. He would not be prepared to conclude from his analyses that the tablets when manufactured contained only 4·77 gr. of acetylsalicylic acid.

Reviewing the case, his Honour said that he had to decide whether the goods in question were reasonable for the purpose for which they were intended, and whether they were of merchantable quality. The first complaint made by the defendant company was contained in a letter to the plaintiff company dated April 5. Nothing more was heard until August 17. It appeared to him that it was not fair to the plaintiff company that the complaint should not have been more definite. The plaintiff company was handicapped in this case because it could not say "we were able to procure part of the consignments complained of and have it analysed within a reasonable time after delivery and have our own independent reports made upon it." He concluded that it was not proved that the tablets delivered, and for which payment was claimed, were not reasonable for the purpose for which they were required, and were not, therefore, merchantable. He thought a reasonable time had elapsed which prevented the defendant company from rejecting the goods. Judgment was accordingly given for the plaintiff company.

OFFICIAL TRADE INTELLIGENCE.

(*From the Board of Trade Journal for November* 24 *and December* 1.)

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W. 1, from firms, agents or individuals who desire to represent U.K. manufacturers or exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department and quoting the specific reference number.

Locality of firm or agent.	Materials.	Reference number.
British West Indies	Cocoa	477
"	Lubricating oils and greases ..	478
Canada	Stationery, writing paper ..	482
New Zealand ..	Medicine bottles	451
Belgium	Ores, metals, iron and steel scrap, aluminium alloys, yellow metal	483
Denmark	Tinplate, black plate	454
"	Surgical cotton wool	4489/F.R./ S.C. 2
"	Pigments, soap, heavy chemicals. etc., (tender for)	
Hungary	Chemicals, pharmaceutical supplies	457
"	Pneumatic tyres	484
"	Colours	486
Italy	China clay	488
"	Essential oils, quinine salts, alkaloids	489
Spain	Chemicals, pharmaceutical supplies, iron and steel	460
Switzerland ..	Glass, china and earthenware..	461
" ..	White enamel for clock dials ..	462
" ..	Cod-liver oil, etc.	463
Turkey	Cement	465
Syria	Drugs	464
United States ..	Artists' materials (oil, paints, colours, papers, glass).. ..	468
" ..	Coal, coke, pig iron, cement, heavy chemicals	469
Argentina ..	Chemicals, glass..	4551/F.L./ P.N.
Panama	Earthenware	475

MARKETS SOUGHT.—A Canadian company desires to establish a connexion with U.K. importers of light glass tumblers. [Inquiries to the Canadian Government Trade Commissioner, 73, Basinghall Street, London, E.C. 2.]

TARIFF. CUSTOMS. EXCISE.

Australia.—Recent tariff amendments affect iron and steel wire, aluminium and nickel, screws, manganese ore, lactose, crude drugs, pharmaceutical preparations, printing paper, photographic plates, films and papers. Superphosphates manufactured within the British Empire from phosphates produced within the Empire are admitted duty free. The value of goods dutiable *ad valorem* is to be taken for duty purposes at the fair market value for home consumption in the country of export at date of shipment, less the actual amount of excise duty paid thereon.

Belgium.—Customs duties on imported sugar, syrups, and molasses are increased by the application of a "co-efficient of increase."

Dominica.—A copy of the Dominican Ordinance containing revised schedules of import duties and free goods, and providing for Imperial Preference for certain goods, may be consulted at the Department of Overseas Trade.

France.—The export and re-export of juice or sauces of tobacco, and of nicotine, nicotine salts and their solutions is prohibited.

Germany.—As from November 23 the premium leviable when the gold duties of the customs tariff are paid in paper currency has been increased from 1900 to 3900 per cent., *i.e.*, 4000 paper marks has to be paid for each 100 mk. "gold" duty.

Greece.—A translation of the modified export regulations may be seen at the Department.

Irak.—A surtax of R. 1 per gross has been levied on imported matches.

Italy.—Modifications have been made in the stamp taxes on perfumery.

Morocco (French Zone).—Candles manufactured in or imported into the French Zone are subject to a consumption tax of 40 fr. per 100 kg. The consumption tax on sugar has been increased to 60 fr. per 100 kg.

New Zealand.—The new customs tariff, now before the Parliament, extends Imperial Preference to mustard, salt, dyes, bottles, jars, electric insulating material, sheet and bar metals, etc. Articles formerly free but now dutiable include rubber tyres, kerosene, benzine and light mineral oils, and linseed oils; duties have been increased on spirits and perfumed spirits; and products hitherto dutiable but now free include various drugs and chemicals for manufacturing purposes.

Portugal.—By a recent modification of the customs tariff system, as from November 24, customs duties are to be paid in gold; increased taxation is applied to imports from countries that discriminate against Portuguese exports, and special duties are applied to counteract dumping. The following goods are exempt from the payment of import duties in gold:—Certain animal oils and fats, hides and skins, camphor, rubber, ebonite, many metals, chemicals, drugs and medicines, etc. Vinegar, wine, alcohol, rubber wares, etc. are exempt from export surtax.

St. Christopher and Nevis.—Import duties on spirits have been amended.

Sweden.—As from November 1, butter may only be exported in containers bearing the trade mark ("rune brand") of the Swedish Butter-Testing Institutions (implying that the water content is not over 16 per cent.) or a mark showing that the butter is not entitled to the "rune brand."

Switzerland.—When imported over other than the Franco-Swiss and Italo-Swiss frontiers, import licences are required for manufactures of rubber, celluloid, emery, and stoneware, and for thermometers, certain types of pyrometers, manometers, hydrometers, vacuum-gauges, and incandescent electric lamps.

Tunis.—Export restrictions have been withdrawn from superphosphates of lime, various fertilisers, organic manures, and bauxite.

Turkey.—Starch, quinine compounds, neo-salvarsan, and compressed aspirin may now be exported without licence.

United States.—The "emergency tariff" is to continue in force until superseded by the permanent tariff now under consideration. The control of dye imports is also to be extended.

TRADE NOTES.

BRITISH.

German-Canadian Trade.—The trade reports issued by the Bureau of Statistics of Canada show that although business with other countries has greatly declined, that with Germany exhibits remarkable growth.

The figures for the five first months of the fiscal year (April—August) for 1920 and 1921 are as follows:—

		1921.	1920.
Apr.–Aug.	Imports	$854,571	$336,990
	Exports	1,829,751	38,157
Aug.	Imports	194,057	54,673
,,	Exports	167,244	64,123

The chief imports consist of chemicals and allied products, iron and iron products, fibres, textiles and textile products, instruments—surgical, dental, optical, mathematical, philosophical—and dolls and toys.

This remarkable development of trade with Germany is surprising, as the latest ruling of the Customs, which came into effect in June, placed an obstacle in the way of increased commercial transactions by fixing the mode of figuring the foreign currency for duty purposes at not lower than one-half of its standard value.

The first large cargo of German goods, since the war, arrived at the end of October per s.s. West Kebar from Rotterdam and Antwerp. It consisted of glassware, iron and non-ferrous products, toys, etc.

Ceylon in 1920.—Cultivation of tea, coconuts, rubber, and other agricultural products are the chief industries of Ceylon, but mining and engineering are also important. Owing to the trade situation the output of tea and rubber had to be restricted in 1920; the export of rubber fell by 3417 tons to 41,597 t., and there was no sign of improvement at the end of the year. The coconut crop was good, prices were high and cultivation was extended; the produce exported comprised 9,776,449 nuts, 67,893·5 t. copra, 25,937 t. desiccated coconut, and 25,376·3 t. oil. Exports of other vegetable products included 2820 t. cacao, 188 t. cardamoms, 73,246 oz. cinnamon oil, 369,976 oz. cinnamon-leaf oil, 1,022,809 lb. citronella oil (of which over one-half went to the United States), and 301,743 lb. kapok.

The production of salt improved slightly to 16,510 tons, but was still much below normal, owing to the refusal of the salt-pan owners at Puttalam to manufacture; the two new Government salterns were started and should produce in 1921. Only fifty graphite mines were working at the end of the year and although the export rose to 9205 tons, the industry is still very depressed; the annual productive capacity of the industry is 30,000 t. Monazite was produced during the year at Bentota and 72 t. of refined sand, containing over 8·5 per cent. thoria, was shipped in November, 1920. Investigation of the laterites of the island has shown the absence of commercial aluminium ores; the content of free aluminia in all the samples examined was negligible and that of silica excessive.

The value of the imports was Rs. 321,275,652, of which the U.K. supplied 24·46 per cent. (14·51 per cent. in 1919); the United States and Japan maintained second and third places with 3·37 and 2·26 per cent., respectively. Imports of fertilisers increased to 90,651 tons, the chief sources being:—United Kingdom, sodium nitrate and ammonium sulphate; Belgium, kainit and superphosphates; France, potassium chloride and sulphate; Egypt and Belgium, basic slag. The value of the exports was Rs. 268,462,183, a decrease of 26·9 per cent.; the U.K. took 46·06 per cent. of the exports, British possessions 15·34 and foreign countries 38·6 per cent., including 22·8 per cent. taken by the United States.—(*Col. Rep.-Ann.*, *No.* 1086, 1921.)

FOREIGN.

The Dye Market in Mexico.—Since the beginning of the year the Mexican market has received large stocks of dyestuffs sent on consignment to local agents by German and Swiss manufacturers, who also send out chemists to demonstrate the application and quality of the dyes. Prices of American dyes and dry colours are respectively 40 per cent. and 80—100 per cent. higher than those of the corresponding European products, so that competition is impossible. Other American chemical products are holding their own, but it may become necessary to follow the German example and place large stocks of goods on consignment to local agents for immediate delivery to purchasers.—(*U.S. Com. Rep.*, *Sept.* 26, 1921.)

Paint and Varnish Market in Belgium.—Despite the existence of an active home industry, the Belgian market for foreign paints, varnishes and mineral colours is of considerable importance, the imports of these in 1920 amounting to 38,682 metric tons, worth 113,343,040 francs, as compared with exports, totalling 34,627 t., valued at 80,947,870 francs. Of varnish (almost entirely non-alcoholic) 1119 tons was imported, Great Britain supplying 78 and France 9 per cent. The importations of paints and mineral colours, 38,682 t., were chiefly derived from France (27%), Germany (24%) and Great Britain (14%). Exports of varnish amounted to 244 t. (U.K. 16%, France 14%) and of paints and mineral colours to 34,627 t. (France 25%, Great Britain 15%, and Holland 9%).—(*U.S. Com. Rep.*, *Oct.* 31, 1921.)

GOVERNMENT ORDERS AND NOTICES.

Safeguarding of Industries Act.—*Part I.* The Board of Trade has ruled that arsenious acid of the usual industrial grades and obtained by roasting the ore and re-subliming is not liable to duty. Further, the prefix "R" is to be added before hæmoglobin, menthol, and nickel oxide, and "sodium monomethylarsonate" is to read "sodium monomethylarsenate."

Part II. A committee has been appointed to consider and report on the complaint lodged by the British Flint Glass Manufacturers' Association and the National Flint Glassmakers' Society that illuminating and mounting glassware from Germany and Czechoslovakia is being sold in the United Kingdom at prices below those at which similar goods can be made in this country.

Mining Dangers Research Board.—Sir J. Cadman and Mr. H. Bramwell have been appointed additional members of this Board.

Export Credits.—The issue of the *Board of Trade Journal* for November 24 contains regulations governing the extended facilities for export credits and guarantees for drafts drawn against shipments of goods exported from the United Kingdom to the British Empire and foreign countries.

Alterations in Danish Patent Law.—By a temporary law, dated December 22, 1919, and a notice, dated September 25, 1921, patent rights belonging to Danish and to British subjects which have lapsed since August 1, 1914, owing to failure to pay duties or to exercise the invention, can again be put into force. Copies of the enactments can be consulted at the Department of Overseas Trade, 18, Queen Anne's Gate, London, S.W. 1.

COMPANY NEWS.

Castner-Kellner Alkali Co., Ltd.—The accounts of this company, which is now controlled by Messrs. Brunner, Mond and Co., reflect the severe slump in trade, but also bear witness to the superior ability of large and powerful organisations to withstand successfully periods of abnormal depression. For the year ended September 30 last, the net profit, £145,600, against £276,300 a year ago, was the lowest for any year since 1909, but even this reduction admits of a dividend of 13 per cent. for the year (22 per cent. in 1919–20). The allocation to depreciation reserve is maintained at £50,000 and this fund now amounts to £737,300. Debentures have been reduced to £165,200 and the general reserve is unchanged at £79,400, invested outside the business. Stocks have risen from £177,100 to £198,700, debtors' account is £160,000 lower at £96,500, and the sum due to creditors is £634,400, as compared with £695,000. The carry-forward is £13,706, as against £48,132 brought in.

Langdale's Chemical Manure Co., Ltd. (Newcastle-on-Tyne).—The directors' report for the financial year ended September 30, 1921, states that the past year was the most disastrous experienced by the company or by the fertiliser trade generally in this country. Owing mainly to the fall in prices of agricultural produce and to the changed policy of the Government, the unprecedented decline in the value of raw materials has necessitated a heavy writing-down of stocks, and the home demand for the company's products has so shrunk that output has been reduced by about one-half. The sale of sulphuric acid was much restricted owing to the closing down of coke ovens through the coal strike, and foreign trade could not be revived owing to the drastic competition of continental makers, who sold below cost and delivered into this country at prices which placed English manufacturers at a serious disadvantage. The loss on the year's working was £28,020, and the debit balance carried forward is £27,036, against which there is a substantial claim for refund of excess profits duty.

British Sulphate of Ammonia Federation.—The report of this undertaking states that the recent difficulties encountered by producers of Chilean nitrate indicate the necessity for close contact between makers and consumers and for exercising more discrimination in the choice of customers than that afforded by financial guarantees. The policy of the Federation consists in taking continuous delivery from its members and in paying them a reasonable interim price for their production month by month. Whereas the consumption of nitrate in this country in 1920 was about two-thirds of the pre-war amount, the deliveries of ammonium sulphate by the Federation were four times as great; 57 per cent. of the production was absorbed by the home market, as against 11 per cent. before the war. A footing has been regained in nearly all the importing countries, and the losses sustained by the closing of markets in America, Germany, Hawaii, and Japan have been more than offset by the increased home consumption. Competition from nitrate of lime and cyanamide has increased, but the German synthetic products have not as yet been offered in this country. As the supply of nitrogen compounds has exceeded the demand, prices have had to be greatly reduced—from £23 5s. per ton (delivered to consumer's nearest railway station) early in the year to £13 13s. per ton in July. Production costs, unfortunately, remain very high; lately there has been some reduction in the cost of fuel, but the price of sulphuric acid has remained practically constant, in spite of urgent appeals to the acid makers. There has been an increased production of neutral sulphate, and the process of manufacture designed at Bedford has been favourably reported upon for use in small works.

REVIEWS.

Animal Proteins. *By* H. G. Bennett. *Industrial Chemistry Series, edited by* Dr. S. Rideal. *Pp. xiii+287. (London: Baillière, Tindall and Cox. 1921.) Price 15s. net.*

The title of this book is not happily chosen. After seven pages of introduction, describing the general chemistry of the proteins, about 190 pages follow dealing with the various methods of tanning leather, followed by some 70 pages devoted to the manufacture of glues and gelatins. Less than 20 pages are devoted to the consideration of the other proteins, including the food-proteins and silk. Surely it would have been advisable to limit the book to an account of the leather industry and its by-products, on which the author is an acknowledged authority? Such a limited treatment of other subjects is without value.

The introduction on the chemistry of the proteins is by no means satisfactory. The seven pages devoted to the subject are inadequate even to impart an elementary knowledge of the fundamental chemical characters of these substances. No indication is given of their polypeptide nature, and an indication of their properties as ampholytes would surely be of importance in explaining their adsorptive capacities, which are constantly referred to in the more technical portions of the work. The introduction, short as it is, is not, however, devoid of inaccuracies. Purine derivatives, for example, do not as a rule occur in proteins themselves but only in other substances such as nucleic acid, with which proteins are sometimes found combined. The introduction also contains some strange statements with regard to the classification of proteins. If retained in a subsequent edition of this work, it should be entirely rewritten.

The greater part of the remainder of the book, which is devoted to a description of the leather industries, fulfils in a satisfactory manner one of the functions mentioned in the preface by the general editor of the series, in "giving a comprehensive survey of the industry. . . . as an adjunct to ordinary text-books."

Certain suggestions may be made as to the arrangement of the matter. At an early stage in the description of the tanning processes reference is made to the lyophil and lyophobe character of the colloids and the influence of these properties on the tanning processes. Surely it would have been advisable to deal with these properties in some detail before using the terms in connexion with the tanning operations. If the author had given a description of the gelatin and glue industries before that of the tannin operations, he would have been able to introduce his chapter on the properties of gelatin and glue in an early stage in the book, and thus have been able to call attention to certain properties of colloids which are repeatedly mentioned in the text preceding this chapter. This, too, requires some words of comment. It is true that the general editor in his preface has suggested that authors of the various monographs in the series should emphasise their own individual views. It seems, however, that the author has gone too far in this direction, and only his own views are given on the very controversial and, up to now, by no means thoroughly understood phenomena of the swelling of gels, a subject of fundamental importance in the treatment of skins and in the technology of glues and gelatins. The chapter on the properties of these products could be improved by some amplification.

S. B. Schryver.

Catalogue of British Scientific and Technical Books. *Pp.* 375. (*London: British Science Guild.* 1921.) *Price* 10*s. net.*

This catalogue has been prepared by a committee of the British Science Guild as a more permanent extension of the list of scientific and technical books published in the catalogue of the British Scientific Products Exhibition organised by the Guild in 1919. The volume contains more than 6000 titles, classified into 50 main groups which are suitably sub-divided for purposes of reference together with an alphabetical list of authors' names and a subject index. The catalogue is restricted to British works, books which are out of print are excluded and practically every branch of science and technology is included. For each volume, the author's name, title of the book, size of page, number of pages, date of the last edition, name of publisher and price are given, data which form very valuable adjuncts to the catalogue. The portion of the catalogue dealing with chemical books is carefully arranged and classified and will be found to be a most helpful guide to all chemists in the recent literature of both pure and applied chemistry.

We notice that the Annual Reports of this Society are not included in the catalogue and hope that this omission will be corrected in a future edition.

The responsibility for the publication of the volume has been undertaken by the British Science Guild which well merits the practical support of chemists and other scientists. The Guild is now housed at 6, John Street, Adelphi, London, W.C.

Technical Records of Explosives Supply. 1915—1918. No. 3. Sulphuric Acid Concentration. *Pp.* 91. *Ministry of Munitions and Department of Scientific and Industrial Research.* (*London: H.M. Stationery Office.* 1921.) *Price* 12*s. net.*

The above publication, compiled by Mr. W. Macnab, is the third of a series of reports dealing with results of scientific and industrial value contained in the technical records of the Department of Explosives Supply of the Ministry of Munitions, and obtained in connexion with operations carried out at one or other of the National Factories during the war.

It may at once be said that the volume is one of extreme interest and should well repay the careful study of all interested in industrial chemistry, illustrating, as it does, the many problems appertaining to the economical working of an apparently simple operation such as is indicated by the sub-heading "Sulphuric Acid Concentration." The volume comprises an introduction; a description and working details of the Gaillard and Gilchrist concentration plants; of the Cottrell precipitation plant, and an appendix. The main interest lies in the description and figures relating to the Gaillard and Cottrell plants, which occupy respectively 49 and 34 pages.

The Introduction, without giving figures, indicates the position the Government had to face, and points to the necessity for war purposes of large units. Amongst such units the Gaillard tower takes a prominent place, and it is stated that "the excellent results obtained have shown this to be one of the best methods of concentrating sulphuric acid, if not the best which was tried." This statement must, of course, only be regarded as applicable where large outputs are required and within the concentration limits generally prevailing at Queen's Ferry, viz., up to 93 per cent H_2SO_4.

The details of plant-construction given in the text are very ample and sufficient. The procedure to be followed in starting up and shutting down units and the outline of the conditions during normal running deserve attention, and the weights of low-strength acid recovered from recuperator, scrubber, etc., together with the strength-variation of fan-drips following temperature variation will prove of interest to all engaged in vitriol concentration. The figures relating to draught through the Gaillard unit also deserve careful attention, as they emphasise the great difference between countercurrent and concurrent flow of gas and liquor in the recuperator (3·7 and 2·4 in. water-gauge, respectively).

The portion of the report meriting the closest study is that dealing with the thermal efficiency of the Gaillard unit. Here are many pages of calculations, but the space occupied is more than justified, as the detailed methods employed and the numerous data contained should serve as models for similar important calculations covering a wide range of operations.

In the case of sulphuric acid, thermal data are fortunately moderately complete and the tables and graphs of Prof. A. W. Porter (Trans. Farad. Society, 1918) have been exclusively used in the present report. A check on Porter's values by calculations from Thomsen's data shows a remarkably close agreement. There results, however, an appreciable discrepancy (p. 42) between the figures obtained in the heat-balance measurement obtained in the Queen's Ferry trial on four Gaillard towers and the figures of the table (works figures approximately 15 per cent. *lower* than Porter's). The trial, however, stands unconfirmed, and for this reason additional large-scale data, if available, would prove of value.

The difficulties to be overcome in carrying out the tests are referred to and it will be very obvious to the reader that such complete tests can only be carried out occasionally. However, with the overall efficiency once established in detail, the data published should enable deductions to be drawn from the records of normal works as to reasons for variation from such established overall efficiency. A further feature worthy of general imitation is the introduction of check methods of calculation.

The notes on the concentration of sulphuric acid (p. 49 *et. seq.*) would be improved by an introduction of the figures for vapour pressures of sulphuric acid in the discussion on strengths of drips, and they should be so considered by those specially interested.

The Gilchrist concentration plant is described, and figures relating to the working are tabulated. The fuel consumption per ton R.O.V. produced indicates high thermal efficiency, but the figures are not discussed in detail and the changed values of strength of feed and finished acid do not permit of ready comparison with the Gaillard operation.

Under Section 3 the Cottrell precipitation plant is described, and the general principles of electrical precipitation discussed. The precipitation in the Cottrell plant is about 70—75 per cent., representing 3 to 3·5 per cent. of the total acid charged to the concentrators, and leaving 1·0 to 1·2 per cent. to go to the chimney. From four towers the actual recovery runs about 30 tons of 51 per cent. H_2SO_4 per day, requiring in electrical energy 620 kw.-hrs. at the treaters and 1930 kw.-hrs. for driving the fan. These figures suggest possibilities when large-scale operations are involved. The descriptive matter shows, however, that the plant is one liable to many troubles; that numerous modifications have had to be introduced, and that the accumulated experience has led to a new design of treater-chamber which has apparently not been tried as yet. Reasons for the alterations—actual and suggested—are given, and add materially to the value of the information contributed.

The appendix gives the free cross-section through coke-filters of any size or grade of packing, wetted surface of same, and a comparison between the results obtained in actual practice and those deduced from an empirical formula for the pressure required to force gases through the coke. All such figures cannot but prove useful in plant-design.

J. T. Conroy.

OBITUARY.

J. SPILLER.

John Spiller, who was born on June 20, 1833, and died on November 8 last, was educated at the City of London School where, in 1848, he was awarded second prize in the first examination in chemistry conducted by Prof. A. W. Hofmann, and at the Royal College of Science, where his fellow-students included Abel, Bloxam, Brazier, Nicholson, and William Crookes. After serving as junior assistant to Hofmann, he joined Dr. John Percy at the Royal School of Mines and carried out, with Allan Dick and Edward Riley, the analyses of "The Iron Ores of Great Britain," the results of which were published in the Memoirs of the Geological Survey. From 1856 to 1858 he was assistant chemist at Woolwich Arsenal under Prof. Abel, during which period he founded the photographic department at the Arsenal, gave lecture-courses on photography at the Royal Artillery Institution and the Royal Military Academy, and several short courses in metallurgy at the Royal School of Gunnery, Shoeburyness. In 1868 he entered the service of Messrs. Brooke, Simpson and Spiller, dye manufacturers, as chief chemist, and he remained with them for twenty years.

Spiller was an original member of the Society of Chemical Industry, a member of Council for several terms, a vice-president from 1885 to 1888, and a member of the Publication Committee from the inception of the Journal in 1882 until 1918. In March of this year he was elected an honorary life member. His connexion with the Chemical Society dated from 1857, when he was elected an associate, becoming a fellow in 1859. He was an original fellow of the Institute of Chemistry and served on its council from 1880 to 1883.

The *Journals* of the Chemical and Photographic Societies, the *Chemical News* and the *Photographic News* of the 'fifties, 'sixties and 'seventies contain numerous communications from his pen on chemical, photographic and other technical subjects, among which may be mentioned:—"The Oxidation of India-rubber" (J. Chem. Soc., 1865, 18,, 44); "On the Decay of Stone; its Causes and Prevention"; a joint paper with Sir W. Crookes on "A Method for Preserving the Sensitiveness of Collodion Plates" (Phil. Mag., 1854); and a paper "On the Action of Chloride of Gold upon certain Salts of Silver" (Phot. J., Aug., 1869), in which he was the first to foreshadow the self-toning silver printing process. He filled many offices of honour in the Royal Photographic Society, including those of president, vice-president, treasurer-secretary, editor of the *Journal*, and at his death he was one of its honorary members.

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GERMAN DESIGNS ON THE CONTROL OF ALSATIAN POTASH.

C. MATIGNON.

Before the war the potash deposits in Alsace were divided among four independent companies: the Société Kali Ste. Thérèse, belonging entirely to French and Alsatian shareholders, and three German companies, the Deutsche Kaliwerke, Wintershall, and Röchling. The Franco-Alsatian company owns an area of 5600 hectares (13,838 acres) with four shafts, sunk or being sunk, of which only one has so far been used.

The three German undertakings, which were placed under sequestration directly after the armistice, were administered under German mining law and constituted the so-called *Gewerkschaften*. A *Gewerkschaft* is a company with a variable capital, which is divided into a determinate number of *Kuxe* (hereinafter termed "shares"), 100 or 1000, inscribed and transferable under certain conditions. Each share represents a definite fraction of the mine, and the holders of shares, as a body, enjoy unrestricted property rights in the deposit included in their concession.

The Deutsche Kaliwerke held concessions over 11,500 hectares, with seven Gewerkschaften, viz., Amélie, Else, Joseph, Alsace, of which four it was the sole proprietor, Marie, Marie-Louise (with 501 shares out of 1000 in each case), and Max (444 shares out of 1000). The remaining shares belonged to French or Alsatian interests.

The group Wintershall administered two concessions covering 3200 hectares, Théodore and Prince-Eugène, and owned 501 shares in each of the two Gewerkschaften, the next largest owner being the Government of Alsace-Lorraine.

The third group, Röchling, controlled the concessions Anna and Reichsland, with a superficial area of 3200 hectares, in which it owned 750 and 600 shares, respectively. The Government of Alsace was a co-proprietor.

Thus practically all the mines were owned by Germans, the exceptions being those belonging to the group Kali Ste. Thérèse and the small shares held in the new companies by Alsatians, individually or collectively. By the fact of sequestration all the Germans became dispossessed of their proprietary rights, and only those Alsatians who were recognised owners of shares before the war were entitled to demand an exchange of their shares against new ones.

An Alsatian industrialist of Guebwiller, M. Henri Koch, who had interests in the Deutsche Kaliwerke group, and was even a member of its supervisory council, and owned therefore a certain number of shares, induced, after the armistice, the German proprietors to transfer to him all their shares for the sum of 49 million francs, which, by the way, was never paid. The contract of sale was dated January 9, 1919, *i.e.*, three days before the properties were placed under sequestration, and at a time when all commerce with the enemy was forbidden. M. Koch applied to the official in charge of the sequestration, M. Helmer, sent him his pre-war securities, and claimed new ones in exchange. The liquidator of the mines, M. Helmer, retained the old securities and refused to deliver new ones in exchange under the pretext that there must have been fraudulent collusion or a fictitious transfer. M. Koch took the case before the district tribunal of Mulhouse, which, on July 29, 1921, delivered a judgment without precedent in the annals of the law, not only on account of irregularity of procedure, but for the tardy disavowal of the judges of Mulhouse, who had accused the clerk of the court of having made an error in the records.

The judgment compelled the liquidator to hand over to the plaintiff new securities in exchange for the old in his possession, as follows:—1000 shares each in the Alsace, Else, and Joseph mines, 999 in the Amélie, 501 in the Marie, 511 in the Marie-Louise, 434 in the Max, and 5 in the Reichsland mine. The judgment ordered M. Helmer personally to pay the costs of the action (200,000 francs) for having refused, in spite of the order of the court, to admit the validity of the transaction of M. Koch. Finally, the court granted leave to appeal on depositing security for 49,290,000 francs. The above list of holdings contains all the shares held by the German group Deutsche Kaliwerke.

The conclusions to be drawn from this very extraordinary judgment are: either the plaintiff was a genuine transferee and the German proprietors were entitled to an indemnity of 49 million francs for the loss of their property, or the plaintiff was only a nominee of the German group, and this group was to remain in possession of a moiety of the Alsatian basin.

Following this decision of the Mulhouse tribunal, the Germans, with some reason, spread the news that they were regaining control of the Alsatian deposits, and consequently the German potash monopoly was being re-established. This presumptive hegemony was too good a thing not to be used to their commercial advantage.

M. Helmer, of course, appealed against the judgment, which amounted to a flagrant judicial error and dispossessed the French Government in favour of the German.

The superior tribunal of Alsace and Lorraine met at Colmar on October 3 last and annulled the judgment of July 29. Its findings were as follows:—

The tribunal: (1) annuls the proceedings of the inferior court and the judgment of the district tribunal of Mulhouse of July 29, 1921, together with all the legal rights resulting therefrom; (2) absolves the defendant M. Helmer from any personal liability and holds him responsible only as liquidator of the potash mines; (3) orders the defendant to deliver to the plaintiff new securities in exchange for the following old, viz., 14 shares of the Max mine, 10 shares of the Marie-Louise mine, and 5 shares of the Reichsland mine; (4) dismisses to that extent the appeal of the defendant; (5) orders the remainder of the costs and expenses to be a charge on the sequestrated property.

Thus the 29 shares acquired by M. Koch before the war are acknowledged to be his property, but the remaining 5450, representing the major part of the concessions of the Deutsche Kaliwerke, viz., 11,500 hectares out of a total of 22,900 hectares for the whole basin, are valueless, in accordance with the Treaty of Versailles.

The mines in Alsace-Lorraine are now producing the equivalent of 230,000 metric tons of pure potash (K_2O) per annum, but exploitation is being extended, improved methods of extraction and purification are being introduced, and more shafts are being sunk with a view to increasing the output. By the end of 1922 the rate of extraction will be about 8500 t. of crude salts a day, and in four or five years it is hoped that the annual production will be over 4 million t. (600,000 t. K_2O), an amount equal to one-half of the world's annual production before the war. Attention is being directed towards discovering extensions of the potash-bearing area; bores sunk to 2925 and 3250 ft. in the Belfort district did not yield positive results, and a bore sunk at Buggingen in Baden, on the opposite bank of the Rhine, revealed a layer of potash salts 13 ft. thick, but not of commercial importance.—(*M. Matignon in "Chimie et Industrie," October*, 1921.)

THE DISPOSAL OF WASTE LIQUORS.*

E. ARDERN.

One of the privileges, or perhaps one should say the penalties, attached to the office of chairman of a Sectional Committee of this Society, is the preparation of an address for the opening meeting of the Session. Such addresses deal either with the progress of the Section or of the Society, or more usually with a subject of specific interest to the chemical industry. The question of sewage disposal as a whole is apparently barred by reason either of surfeit, so far as this Section is concerned, or because the subject has been in the past decidedly contentious, and it would be manifestly unfair to deprive the general body of members of a certain measure of enjoyment by taking advantage of the fact that no discussion of the chairman's address is allowed. It was, therefore, necessary to find a subject with which the author was not entirely unacquainted, and which at the same time might prove of fairly general interest to those actually engaged in the industry. The question of the disposal of waste liquors resulting from manufacturing processes appeared to be the most promising, and it is therefore proposed to treat it in a brief and general manner, with the idea of more or less defining the position of the manufacturer in relation to (a) the question of rivers pollution, and (b) to local authorities. The subject thus falls naturally into two divisions, viz.:—

I. The discharge of waste liquors into natural water-courses, and

II. The discharge of waste liquors into sewerage systems.

I. At the present time control over the character of waste liquors discharged into water-courses is effected by (a) action at common law by riparian owners below stream, and (b) action by the district sanitary authority, which may be the local authority, the county authority, or certain joint rivers boards which have control over rivers and streams in particular water sheddings, and which have authority to take proceedings under the Rivers Pollution Prevention Acts or certain special Acts.

Evidently control under (a) is most variable, and is entirely dependent on infringement of water rights held by riparian owners below stream, so that actual damage of the water-course must have taken place sufficient for it to be established beyond doubt that the riparian owner in question has been prejudiced before action may be taken successfully.

In comparing the nature of control effected by riparian owners and sanitary authorities several differences are exhibited. A riparian owner would have ground for action if the discharge above stream of waste liquor into a water-course had given rise to one or more of the following effects, viz.:—(i) Material increase in the hardness of the stream water; (ii) appreciable increase in the amount of iron in solution; and (iii) the presence of colouring matter; any one of which might very possibly affect prejudicially the riparian owner in the course of his manufacturing processes, whereas it is extremely problematical whether the sanitary authority would be allowed to take proceedings on any of these grounds. On the other hand, sanitary authorities are not impeded by any question of prescriptive right, as such claim would be no defence against proceedings taken under the Rivers Pollution Acts.

In discussing the right of action by controlling agents, the question of what constitutes a polluting liquor arises. There is no legal definition, and, moreover, all authorities are agreed on the extreme difficulty of fixing any chemical standard which could be applied equitably to all classes of industrial waste, especially having regard to the means of their purification. In fact, one might go further and say that most authorities are agreed that, if not impracticable, it is certainly undesirable to establish a definite legal standard.

Although certain broad principles may be applied to the consideration of what should not be allowed in waste liquors discharging into natural water-courses, such as (i) excessive suspended matter; (ii) highly putrescible matter; (iii) material acidity or causticity; (iv) sulphides or other readily oxidisable compounds; (v) free chlorine or other sterilising agents; the writer is in agreement with the view generally accepted, and more or less recommended by the Royal Commission on Sewage Disposal, viz., that pollution is best determined by the ascertained effect on the water-course itself.

The inspection and examination of the water-course, above and below the point of discharge of waste liquor, for this purpose, includes careful observation or determination of (a) the condition of bed of the stream; (b) any difference in the flora and fauna; and (c) chemical examination of the stream water, with especial reference to any increase in the amount of organic matter capable of undergoing fermentation. This is usually ascertained by determining (1) the dissolved-oxygen content of the water, or (2) the amount of dissolved oxygen absorbed by the various samples of stream water when diluted with aerated water and incubated in a filled bottle for a definite period. In detecting pollution effect the latter test is much more sensitive than the determination of oxygen absorption from acid permanganate.

This method of determining pollution is, of course, liable to be interfered with by trade wastes which have a bactericidal effect on the watercourse, and obviously is also inapplicable in the case of a watercourse already seriously polluted, otherwise considerable advantages would be enjoyed by manufacturers on the lower reaches of streams, and improvement in the character of a polluted watercourse could only be effected gradually from its source downwards. In such cases, a certain standard purity of stream water has to be assumed and the effect of the specific waste liquor judged by consideration of the questions of dilution and of the amount of fermentable matter contained in the waste liquor.

As stated previously, control dependent on the action of riparian owners is unsatisfactory. Unfortunately, it must be admitted that this also applies to the control exercised by practically all sanitary authorities, as legal proceedings for pollution are greatly hampered by restrictions and by saving clauses in the various Acts of Parliament concerned, which, according to Maclean Wilson and Calvert, may be summarised as follows, viz.:—

I. Rivers authorities have no power to act in the case of a new undertaking which it is known must discharge polluting liquor, *i.e.*, they must wait until pollution actually occurs.

II. They must obtain consent of the Ministry of Health before taking proceedings, and this often means a local inquiry by the Ministry.

III. After such consent has been obtained, two months' notice must be given to the offender of the intention to take proceedings.

IV. No provision is made for preventing mismanagement of purification works already constructed, except by repeating the above legal processes.

It is thus apparent that considerable simplification is needed to ensure satisfactory progress in the matter of rivers pollution. Moreover, it is generally accepted that the various sanitary authorities throughout the country have by no means adopted a uniform standard of action; in other words, specially-constituted rivers boards take a more serious view of their responsibility in the exercise of powers concerning rivers pollution than certain county councils, which by the Local Government Act, 1888, have the power of enforcing the Rivers Pollution Acts, with the result that manufacturers throughout the country are not accorded equal treatment.

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* The Chairman's Address to the Manchester Section, October 7, 1921.

In making this statement no reflection is made on the county council or other sanitary authority in question, as such authorities have usually no staff, or, if any, quite an inadequate one, to supervise the discharges of waste liquor within their area, whereas the joint rivers boards have an inspection staff capable of effecting adequate control.

The writer has, therefore, no hesitation in saying that the time is long overdue when effect should be given to the recommendation of the Royal Commission on Sewage Disposal with respect to the formation of additional rivers boards and the establishment of a central rivers authority to co-ordinate, encourage, and assist in various ways the operation of such boards.

The establishment of such an authority on right lines should ensure more uniform treatment of manufacturers throughout the country in respect of the character of waste liquors discharged, and at the same time effect a general improvement in the character of water-courses in industrial areas. In the opinion of the writer, there is plenty of room for improvement in this respect, without affecting materially the interest of the chemical industry as a whole.

II. Generally speaking, the question of admittance of manufacturers' trade waste into public sewers is governed by (a) Section 7 of the Rivers Pollution Prevention Act, 1876, which states that every sanitary or other local authority having sewers under their control shall give facilities for enabling manufacturers within their district to carry the liquids proceeding from their factories or manufacturing processes into such sewers: Provided that this section shall not extend to compel any sanitary or other local authority to admit into their sewers any liquid which would prejudicially affect such sewers, or the disposal by the sale, application to land, or otherwise, of the sewage matter conveyed along such sewers, or which from its temperature or otherwise may be injurious from a sanitary point of view; provided also that no sanitary authority shall be required to give such facilities as aforesaid where the sewers of such authority are only sufficient for the requirements of their district, nor where such facilities would interfere with any order of any court of competent jurisdiction respecting the sewage of such authority; and (b) Sections 16 and 17 of the Public Health Acts (Amendment) Act, 1890, which read thus:—

Section 16: (1) It shall not be lawful for any person to throw, or suffer to be thrown, or to pass into any sewer of a local authority or any drain communicating therewith, any matter or substance by which the free flow of the sewage or surface or storm water may be interfered with, or by which any such sewer or drain may be injured.

(2) Every person offending against this enactment shall be liable to a penalty not exceeding ten pounds and to a daily penalty not exceeding twenty shillings.

Section 17: (1) Every person who turns or permits to enter into any sewer of a local authority or any drain communicating therewith (a) any chemical refuse, or (b) any waste steam, condensing water, heated water or other liquid (such water or other liquid being of a higher temperature than 110° F.) which either alone or in combination with the sewage causes a nuisance or is dangerous or injurious to health, shall be liable to a penalty not exceeding ten pounds and to a daily penalty not exceeding five pounds.

Sections 15 and 21 of the Public Health Act, 1875, provide that the local authorities shall build sewers adequate for the effectual drainage of their district, and that the owner or occupier of any premises within the district shall be entitled to cause his drains to enter the sewers, but it has been held (Local Government Board Inquiry, June, 1898) that there is no obligation on the local authority to provide sewers large enough to accommodate manufacturers' trade waste. Further, it has been held by the Court of Appeal in Brook, Ltd. *v.* Meltham Urban District Council (1908, 2 K.B. 780) that Section 21 of the Act does not give manufacturers right of access to the sewers of the local authority.

In addition to the above-mentioned general Acts of Parliament, many local authorities have obtained private Acts conferring upon them special powers with regard to the reception of trade waste into their sewers. Briefly, these special powers include provisions for (a) power to require preliminary treatment whereby trade effluents shall comply with certain regulations embodied in a common law agreement between the authority and the manufacturer, *e.g.*, Manchester Corporation (General Powers) Act, 1902; and (b) power to levy special charge on manufacturers, additional to the ordinary sewerage and sewage disposal rate of the district, for which, of course, they are liable, with or without preliminary treatment of the waste liquor prior to discharge into the sewers, *e.g.*, Halifax Corporation Act, 1905, part II.; Huddersfield Corporation Act, 1906, part II.

The question of disposal of manufacturers' waste liquor was referred in 1898 to the Royal Commission on Sewage Disposal, which in its Third Report (1903) made certain recommendations that may be summarised as follows, viz.:—

That in their opinion the law should be altered so as to make it the duty of the local authority to provide such sewers as are necessary to carry trade effluent as well as domestic sewage (incidentally, this was already held to be the case in Scotland), and that the manufacturer should be given the right, subject to the observance of certain safeguards, to discharge trade effluents into the sewers of the local authority.

That the local authority should frame regulations which should be subject to confirmation by a central authority.

The above recommendations were qualified by stating that cases may arise in which the local authority should be either wholly or partially relieved from the afore-mentioned responsibility.

That whereas, in general, no special charge should be made on the manufacturers where the regulations with respect to preliminary treatment are complied with, the local authority should be empowered to make a special charge where the manufacturer is unable to comply with these regulations. Power should also be granted to make a special charge even when preliminary treatment is adopted, where there are exceptional circumstances as regards volume, quality, or otherwise. The actual amount of such charge to be fixed by agreement between the manufacturer and the local authority, or in default of such agreement, by reference to a superior authority.

That all manufacturers should be treated alike, those already discharging into the sewers and new connexions.

It was finally recommended that differences between local authorities and manufacturers with respect to (a) variation of the general regulations respecting preliminary treatment to meet particular cases, (b) amount of special charges to be imposed on particular manufacturers; (c) the question whether the preliminary treatment adopted by manufacturers complies with regulations, should be referred to the Rivers Boards controlling the particular area (these were recommended to be formed throughout the country), with right of appeal by either party to the central authority, which the Commissioners also proposed should be established.

Effect, however, has not yet been given to these recommendations. Although no general Act of Parliament has since been passed dealing with this matter, the above-mentioned private Acts of Huddersfield and Halifax were passed by agreement between the local authorities and manufacturers. In these Acts the local authority accepts responsibility for the reception of trade waste into the sewers, subject to certain provisions, and existing connexions are subject to the same conditions as connexions made subsequent to the passing of the Acts.

It will be seen from the foregoing that the general Acts of Parliament do not define very clearly the position of the manufacturer in relation to the local authority, and consequently there is a decided lack of uniformity in the treatment of manufacturers throughout the country with reference to the disposal of their waste liquor by discharge into public sewers, having regard to the various private Acts enforced by certain local authorities.

In certain instances manufacturers' trade waste, especially where old connexions exist, is admitted to sewers without any control whatever and without any special charge; in other cases preliminary treatment is required without special charges, and in several districts the manufacturer is charged varying amounts for the privilege of discharging waste liquors into the sewers, either with or without preliminary treatment.

In special cases manufacturers have been called upon to bear part of the capital expenditure on sewage-purification works of the local authority as well as an annual charge, additional to the ordinary sewerage and sewage disposal rate levied throughout the district.

As the result of a fairly extensive experience of the subject, the writer offers the following suggestions with the view of affording an equitable settlement of this important question of the relative responsibilities of the local authorities and manufacturers, which it will be seen, in general, follow on the lines recommended by the Royal Commission on Sewage Disposal:—

(1) That, subject to certain reservations, it is the duty of the local authority to accept responsibility for the admission of trade effluents into its sewers.

(2) That all trade effluents should conform to standard regulations framed by the local authority and confirmed by a joint committee of the local authority and manufacturers in the district, or, failing agreement, by reference to a central authority.

(3) That there shall be no differential treatment as between manufacturers already discharging waste liquors into the sewers and those applying for new connexions.

(4) That the local authority shall be empowered to make a special charge (agreed upon as under (2)) when the character or volume of waste liquor, even after compliance with the general regulations, would affect the nature of the total sewage flow of the district as to increase materially the cost of its purification.

The writer is of opinion that the local authority should have power to prohibit, without recourse to complicated legal machinery, the discharge of waste liquors into sewers where they may (*a*) give rise, either alone or in combination with the sewage itself, to conditions dangerous to the life or health of workmen engaged in the sewers; (*b*) create serious nuisance; and (*c*) so alter the character of the sewage as to disorganise any practicable type of sewage purification plant.

In view of actual experience these points are considered of the first importance. Usually, under present conditions, danger to health or even loss of life actually has to occur before action is or can be taken; and more than one instance may be cited where sewage purification plants have been rendered practically inoperative as the result of certain improper discharges into the sewers. The local authority should certainly have the right to guard against such occurrences, without having to wait for danger or damage to happen.

Naturally, there is considerable difference of opinion on the question of special charges for the reception of trade waste into public sewers. Inasmuch as the admission to the sewers of by far the majority of trade wastes, even after preliminary treatment, must increase in varying degrees the ultimate cost of the purification of the sewage, the general ratepayer naturally holds the view that such increase in cost should be borne by the manufacturer as a legitimate trading charge. On the other hand, the local authority must have regard to the advantages accruing to its district by the establishment of industries in which the production of waste liquor is unavoidable.

Although the writer is fully aware of the difficulties attending control of preliminary purification plant, and, moreover, has the knowledge that several authorities possessing private Acts giving them the power to require preliminary treatment, have preferred, in view of the above difficulties, to adopt a scale of special charges for the reception into their sewers of crude trade waste of varying character, as being the simplest way out, it will be seen that he is of opinion that only in certain cases should special charges be made for the reception of trade effluents into the sewerage system.

His experience leads him to believe that if the proposed regulations are conceived in a reasonable spirit, the majority, at any rate, of manufacturers will appreciate fully their responsibility in the matter. Provision should be made, however, for guarding against inadequate control of any preliminary purification plant, and penalties should be imposed for wilful neglect of such plant. Briefly, the general regulations referred to would, of course, include provision against effluents, whose discharge into sewers is not prohibited, and also with regard to (*a*) equalisation of flow, (*b*) limit of temperature, (*c*) limit of amount of suspended solids, and (*d*) acidity. Regulations framed on these lines would permit of effluents containing dye-liquors or heavily charged with oxidisable matter of varying character, and it is in respect of the amount and character of such matters that the question of special charge would arise. It is clear that a satisfactory solution of this vexed problem calls for the hearty co-operation of both local authorities and manufacturers, between whom it is of the utmost importance that amicable relations should be established.

In conclusion, the writer would urge manufacturers, in their own interests, to give more serious consideration than is usually given to the subject under review. He considers that this question of the disposal of waste liquor should be definitely treated as an integral portion of any manufacturing problem, if not equally important as such matters as water supply or transport facilities. Although it would be foolish to suggest that in the majority of cases actual profit may be anticipated from a closer attention to the character of the waste liquors discharged from any manufacturing process, it is well known that this has often proved to be the case. Moreover, it is seriously contended that a closer study of the nature of the resultant waste liquor will assist materially in the efficient control of the manufacturing process itself.

THE COPRA TRADE OF THE PACIFIC.

The issue of the *United States Commerce Reports* for November 7, 1921, contains an informative article on the above subject together with remarks on conditions in the copra industry generally. The countries and islands of the Pacific which come into consideration are the Dutch East Indies, the Straits Settlements and British Malaya, Fiji, the Philippines, Australia, Japan, Tonga, the Solomon Islands, and New Zealand. The total export of copra from these countries in 1919 amounted to about 545,000 tons, of which over 325,000 t. was exported from the Dutch East Indies, more than 115,000 t. from the Straits Settlements and British Malaya, followed by about 27,000 t. from Fiji and 25,000 t. from the Philippines. In many cases most of the copra was exported to Europe, but of the exports from the Dutch East Indies, over 20,000 t. was shipped to the Philippines and over 58,000 t. to the Straits Settlements and British Borneo, whilst a total of over 115,000 t. was exported to the United States. Of the world's total crop of copra, about 10 per cent. is derived from the Pacific archipelagos, 16 per cent. from the Dutch East Indies, 15 per cent. from the Philippines, 55 per cent. from Ceylon and the continent of Asia, and 4 per cent. from Africa and tropical America.

It has been estimated unofficially that about 2000 million dollars is invested in coconuts and in plants handling the products, and that of this sum more than one-half represents investments in land and groves. In spite of the capital involved and the great importance of the coconut crop to the world's food supply, the methods of cultivation and of preparing and handling the copra are as a rule inefficient. Most of the groves are more or less stifled with undergrowth and receive little cultivation; even in British Malaya, which contains many of the best groves, the proportion of well-tended trees is small. In Java the ratio of bearing palms under European supervision to native-owned palms is about 1 to 500, and in the Philippines less than 1 per cent. of the palms is properly cultivated and the average annual yield of 25 nuts per tree is about one-fourth of the normal crop under efficient cultivation. The native methods of drying are wasteful, the copra being often insufficiently dried and damaged by smoke, and unripe nuts are also used; in fact, it is said that owing to these defects most of the copra from the Pacific reaches the European oil-mills with only 75 per cent. of the oil content possible under proper conditions. The quality of the oil manufactured is also lowered and refining processes of a more or less expensive and complicated nature are required to render the oil suitable for edible purposes.

Important changes have been brought about during the last few years by the erection of many oil-mills in Pacific countries, particularly in the Philippines, Dutch East Indies, Australia, the Straits Settlements, and French Oceania. By manufacturing oil in the coconut-growing countries, a better quality of oil is produced, deterioration of copra during transit is avoided, and freight is saved, but the serious difficulty of providing containers for the oil is introduced. Steel drums are expensive, wooden casks are unsatisfactory, and although second-hand petroleum tins are cheap in some localities, they are not very satisfactory, and the writer can point out that they are regarded with much disfavour by oil-refiners on account of the trouble and expense involved in opening and getting out the oil. Tank steamers would be efficient, but a petroleum tanker can hardly be made fit for edible oil or afford to make the return voyage in ballast. The shortage of containers appears to be so acute in some cases that oil-mills have refused to buy copra except at a fraction of its normal price, and in consequence copra has had to be shipped to Europe and to suffer deterioration in transit.

Another important consideration is the excellent demand for the cake in Europe, where it has a good reputation as a feeding-stuff, particularly as a concentrated feed for dairy cattle.

In April of this year only one of the "Insulinde" mills of the Dutch East Indies was working and many of the new mills in the Philippines were in difficulties, though large cargoes of copra were being exported. In the future it is likely that the production of copra will increase largely in the Western Pacific, in the ex-German possessions, Papua, the New Hebrides and the Solomon Islands, as the large plantations made just before the war are expected to come into full-bearing shortly and may possibly double the output within five years.

Increased crops are also likely in the Non-Federated Malay States, the Dutch East Indies and the Philippines, but Polynesian countries are unlikely to yield increased crops as the extension of native groves is difficult and the natives have little incentive to produce more copra at the present price. The Philippine oil-mills are capable of working more than the normal yearly crop of these islands (250,000 t.), and would welcome imports from the Dutch East Indies and elsewhere, but it seems unlikely that the mills of the Dutch East Indies, Japan, and Australia would encourage exports to the Philippines while copra can be exported at a profit to Europe.

NEWS FROM THE SECTIONS.

MONTREAL.

Mr. H. W. Matheson, chairman of the Section, presided at the opening meeting of the new session, held on November 18 in the Queen's Hotel, Montreal. The attendance, which included Prof. R. F. Ruttan, numbered 53. After a discussion, it was unanimously agreed to take steps to form a General Council of the Society for Canada through which Canadian chemists would be able to speak with one voice on matters of national importance, such as legislation, and which would act as an expert advisory board for technical affairs.

Prof. R. de L. French read a paper on "The Carbonisation of Western Lignite." He pointed out that although there were very rich coal deposits in British Columbia, the 2000 miles which separated this district from the manufacturing districts in Ontario and Quebec made it vitally important to utilise every available source of fuel nearer to hand. The lignite deposits in Saskatchewan were of the lowest grade, and the mineral was so friable that transportation was impossible. Carbonisation on the spot had therefore to be resorted to and a char or coke produced which would be suitable for conversion into usable briquettes. By carbonisation a product was obtained which approximated to that resulting from geological ageing, the calorific power being increased and a less smoky fuel being obtained.

The author explained in detail the mechanical difficulties which had to be overcome to secure a uniform flow of the granulated lignite over the inclined bed of the carbonising chamber, the methods adopted for preventing the formation of explosive gas mixtures in the plant, and the use of this gas and the tar produced as fuel for heating the carboniser. Much trouble was experienced by the makers of the carborundum plates forming the bed of the carbonising chamber in securing a sufficiently uniform surface, and a very high percentage of these plates was rejected. Methods used in the ordinary coal-gas plant were found to be quite inapplicable to the treatment of lignite. The work now being carried on was large-scale experimental work, and no attempt had yet been made to investigate the value of the by-products, as the supply of ammonium salts from other sources was in excess of the demand, and the tar, oil and gas were used as fuel.

Mr. Ephraim Levitt then read a paper on "A New Commercial Method for the Decomposition of Clays and Felspars," which if found to be practicable on plant-scale will enable Canada to produce aluminium sulphate, very large quantities of which are now imported for use in the paper and pulp industries and for the treatment of potable water, and water glass, of which there is consumed many thousands of tons annually, and all of which is imported. Potassium in considerable quantity would also be obtained, and as the raw materials are found in the Dominion an extremely valuable group of new industries would be built up.

Briefly, the process consists in fusing the clay or felspar with calcined boric acid, mixing with water, saturating with sulphur dioxide, whereby the bisulphite and re-formed boric acid go into solution, leaving the silica undissolved, which when removed by filtration and freed from the remaining traces of boric acid by washing, is readily soluble in caustic soda. The filtrate containing the metallic bisulphites and some boric acid is boiled, the bisulphites converted into sulphites and aluminium hydroxide precipitated. Solution in sulphuric acid or calcination then gives either sulphate of aluminimum or alumina, free from iron.

Prof. Ruttan expressed the hope that some manufacturers would give this process a trial on a large scale as it showed possibilities of national and Imperial importance.

At a committee meeting, held on November 14, Dr. R. M. Maclean and Mr. Harold J. Roast were elected vice-chairmen of the Section, and Mr. W. B. Woodland was appointed to act as hon. secretary during the absence of Mr. W. P. Dickson.

MANCHESTER.

The third meeting of the session was held on December 2 in the Textile Institute, Dr. E. Ardern presiding.

A paper on "Heat-balance on Recovery Producer-Plant with Gas-Engines" was read by Mr. W. H. Norris, who described an ammonia-recovery producer-plant capable of gasifying 1000 tons per week of bituminous slack, with cleaning plant to purify 20 million cb. ft. of producer gas daily. The power-plant had a total capacity of over 5000 kw. per hour, and consisted of vertical gas-engines directly coupled with direct-current generators, much of the heat of the exhaust gases being recovered in the form of steam from waste-heat boilers. The data, recorded as graphs, covered a period of 8 months. The coal was sampled twice daily and the averaged sample analysed weekly; the power-record was kept half-hourly, the waste-heat controlled weekly, and engine- and boiler-tests were carried out at intervals. The over-all efficiency of the station was shown as well as the individual efficiencies of the sections worked. From these data and measurements of temperature over the plant, a heat-balance representing a month's working was drawn up and illustrated by "trunk diagrams" showing the final distribution of the heat units which entered the producers, either as fuel or steam; and these diagrams were compared with similar diagrams for steam-turbine generators.

"A Note on the Direct Titration of Alkaline Manganates" was read by the hon secretary in the absence of the author, Dr. J. J. Bloch. The solution of manganate or permanganate is diluted with hot water, and semi-normal solution of manganese sulphate is added slowly, the temperature being maintained at 60°—70° C. The precipitated manganese compound is allowed to settle and the addition of sulphate continued until the supernatant liquid is colourless. This method obviates the necessity for acidifying the solution prior to or during titration, and thus admits of prompt determinations being made in the control of a works' process.

NEWCASTLE-ON-TYNE.

A general meeting was held in the Chemical Lecture Theatre of Armstrong College on December 14, Dr. J. H. Paterson in the chair.

Messrs. L. A. Sayce and A. Crawford presented a short note on their work concerning "The Estimation of Carbon Dioxide in Mineral Carbonates," and for which the chairman presented to them the Saville Shaw Medal, this award having been recommended by the professor of chemistry in the Armstrong College.

The paper describes experiments on the comparative suitability and consistency of certain methods for estimating carbon dioxide in calcite, witherite, dolomite, chalybdite, and cerussite. These methods were:—(*a*) Simple ignition; (*b*) Schrötter's method and a simple modification of it; (*c*) a method devised by Dr. F. C. Garrett in which dilute acid is added gradually to the carbonate and the carbon dioxide, after drying, is aspirated through caustic potash or soda-lime; and (*d*) by the use of Scheibler's apparatus as modified by S. H. Collins (*cf.* J., 1915, 518). The conclusions of the authors are that (*a*) is accurate and consistent when applicable; that in (*b*) the use of sulphuric acid is unsuitable if the sulphates of the metals present are comparatively insoluble; (*c*) is capable of considerable accuracy; and (*d*) is very well adapted for use with carbonates that are readily decomposed by acids, and is accurate to the extent of at least 1 part in 300.

Mr. A. Weighell's paper on "The Agglutinating Value of Some Durham Coals," described tests on samples obtained from eight collieries on the western margin of the Durham coalfield. The samples were crushed to pass a 60-mesh sieve, and the relative proportions retained by sieves of different mesh were determined. Electrode carbon was used as the inert material, but instead of using fixed weights of it in successive degrees of fineness as proposed by Sinnatt (*cf.* J., 1920, 83 T), increasing weights of the same grade were employed. The dry, crushed coal (1 gm.) was mixed with just sufficient carbon (100-120 mesh) to destroy the caking property of the mixture, and heated for a definite time in a platinum crucible. After cooling, a 100-gm. weight was laid on the button of coke, and if the latter fell to powder, the proportion of inert material to 1 gm. of coal was taken as the agglutinating value. The results of the tests were given in tabular form.

Mr. S. H. Collins read a short paper on "The Estimation of Lævulose in Straw."

BIRMINGHAM.

Prof. A. R. Ling and Mr. D. R. Nanji presented a paper on "A New Method of Preparing Gluconic Acid" to the meeting held in the University on December 15.

The method of preparing gluconic acid for use on a technical scale suggested by Herzfeld and Lenart, viz., by oxidising dextrose with free bromine in aqueous solution, is open to the objections that it involves the use of more bromine than is needed theoretically, and that the reaction usually takes 24 hours for completion. Instead of bromine, the present authors use an amount of calcium bromide corresponding in potential bromine content to 26 per cent. of the bromine used by Herzfeld and Lenart. A slow, regulated current of chlorine is passed through an aqueous solution of dextrose and calcium bromide containing 0·025 per cent. of cobalt nitrate, which acts as a catalyst. The temperature is maintained at 45°—50° C., and calcium carbonate in the theoretical quantity is added at intervals to counteract the retarding action of the halogen acids. The reaction is complete in about 4 hours and the resulting solution of calcium gluconate, chloride and bromide, after concentration, deposits crystals of the gluconate within a few days. The yield is about 90 per cent. of the theoretical, or greater if the mother liquor be treated with strong alcohol.

LIVERPOOL.

On December 16, in the Muspratt Lecture Theatre of the University, Mr. R. Thomas read a paper on "The Recovery of Solvent Vapours from Air," in which he particularly referred to alcohol employed in the manufacture of transparent soap. He first described a simple method of determining the partial pressures of alcohol and water in an aqueous solution of the former, or, alternatively, a method of analysing air containing a mixture of alcohol and water vapour. The method depends on the observation that water vapour is quantitatively removed from air by calcium carbide, whereas alcohol is not touched. It was shown that for dilute solutions—up to 10 per cent. at least—Henry's law held good, and tables were exhibited showing the ratio of the concentration of alcohol in the gaseous phase to its concentration in the liquid phase for temperatures from 15° to 25° C. Alcohol is recovered after use in the manufacture of transparent soap by drawing a current of air at suitable velocities over the soap, stacked in stoves of suitable design, and scrubbing the air with water in one or more scrubbers. Expressions were deduced showing the relation between the amount of alcohol vapour in the air, and the amount recoverable from a given volume of air, using a given volume of water, and experimental results were given showing the agreement between calculated and observed values both on a laboratory scale and also on a manufacturing scale. It was shown that with a concentration of 2 lb. of alcohol per 1000 cb. ft. of air, up to 78 per cent. of the alcohol can be recovered as an 8 per cent. solution if 10 tons of water be used per one million cb. ft. of air; with two towers up to 88 per cent. is recoverable under the same conditions.

CHEMICAL INDUSTRY CLUB AND THE LONDON SECTION.

A joint meeting of these organisations was held in the lecture theatre of the Institution of Mechanical Engineers, S.W., on December 13, for the purpose of witnessing a display of kinematograph films depicting certain industrial processes. Mr. W. J. U. Woolcock presided, and was supported by Mr. A. G. Craig, chairman of the executive committee of the Club, and Mr. E. V. Evans, chairman of the London Section.

Mr. Woolcock, in a short introductory speech, referred to the possibilities of the kinematograph as an aid to experimental research. He understood that the new ultra-rapid camera enabled motion pictures to be taken at 10—14 times the rate which had hitherto been possible, and he thought that if pictures of scientific phenomena taken with it were subsequently projected on the screen at a much slower rate, new and valuable facts would probably be revealed.

The films projected were (1) "The Winning and Working of Sulphur," by the Frasch process in Louisiana (*cf.* J., 1912, 168—176), kindly lent by Messrs. Chance and Hunt, Ltd.; (2) "The Manufacture of Steel by the Crucible, Open-hearth, Electric, and Bessemer Processes," lent by Dr. W. H. Hatfield, of the Brown-Firth Research Laboratories, Sheffield; and (3) "The Metallurgy of Zinc Production," by Gaumont Frères.

An "omnibus" vote of thanks to the Institution of Mechanical Engineers, to those who had lent the films, and to the chairman, was proposed by Mr. Craig, seconded by Mr. Evans, and carried with acclamation.

MEETINGS OF OTHER SOCIETIES.

THE ROYAL SOCIETY.

A paper dealing with the comparative rates of absorption of hydrogen at different pressures by a variety of unsaturated compounds in presence of nickel was presented by Drs. E. F. Armstrong and T. P. Hilditch to the meeting held on December 8.

The authors have established that simple ethylenic compounds are hydrogenated, in presence of sufficient nickel, at rates which are in approximately exact proportion to the absolute pressure of the hydrogen. At extremely low concentrations of catalyst, the increase in rate of hydrogenation becomes less than proportional to the increase in pressure, especially in the cases of multi-ethylenic compounds such as linolein or citral. On the other hand, the presence of a group in the organic compound which has affinity for nickel but is not open to hydrogenation causes the speed of hydrogenation to increase abnormally rapidly as the hydrogen pressure is increased. Thus the relation between rate of action and hydrogen concentration is evidently governed by the type of organic compound present.

This investigation is the most detailed examination which has been made of the influence of the hydrogen pressure on the rate of liquid hydrogenation, and the results harmonise completely with the view that the process is primarily conditioned by an association of the ethylenic linkage with the catalyst, the latter being also associated with hydrogen.

THE OPTICAL SOCIETY.

The following papers were read and discussed at a meeting held in the Imperial College, S.W., on December 8:—

(1) "The Physical Meaning of Spherical Aberration": L. C. Martin. Experimental determination of the intensity of light near the focus of a lens system showed that the "spurious disc" appearance persisted at the best visual focus, even in the presence of large amounts of aberration. The effect of increasing aberration is to draw light from the central concentration and scatter it in the surrounding field, and, from measurements of the loss, the necessity of restricting the phase residuals to within $\lambda/6$ is inferred. Spherical aberration is found to produce marked asymetry on each side of the focus —a matter of great importance in some optical instruments.

(2) "An Auto-Stroboscope and an Incandescent Colour Top": Dr. F. L. Hopwood. A description was given of some novel optical phenomena which may be observed when revolving incandescent filaments are viewed. The production of a variety of stationary dark images due to the eclipse of an incandescent wire by an adjacent cold wire or opaque object, when both are revolving round a common axis, was described, and it was shown how

the phenomena might be practically applied to the study of the behaviour of a rotating body, by converting such a body into an auto-stroboscope. A demonstration was given of the use of a spinning incandescent electric lamp as a colour top and for exhibiting after-image effects.

(3) "Achromatic One-Radius Doublet Eyepieces": Lt.-Col. J. W. Gifford. Eyepieces both of the Huygenian and the Ramsden types have been constructed from pairs of one-radius achromatic doublets with external plane surfaces to the flint lenses. They compare well with the German orthoscopes in definition, and the cost of production is sensibly less. Such eyepieces are adapted either for the telescope or the microscope. By their use a much more perfect achromatism is obtained as well as a flat field.

THE CHEMICAL SOCIETY.

At the ordinary scientific meeting, held on December 15, the President, Sir James Walker, announced that the Council had accepted the gift of a bust of the late Mr. J. J. Griffin, who was an original member of the Society; also that at the next ordinary meeting, on January 19, Prof. Arthur Smithells would give an account of Langmuir's work on the constitution of the atom. He drew attention to the forthcoming exhibition of apparatus at the Imperial College of Science on January 4 and 5, and read an appeal for English books on behalf of the Republic of Latvia. The Chemical Society is sending its publications from 1914 to date for the University of Riga.

The following two papers were read:—"Researches on Residual Affinity and Co-ordination. Part VII. Cobaltic Lakes of the Alizarin Series": G. T. Morgan and J. D. Main Smith. "A Note on the Substitution of Benzene and the Law of Constancy of Substitution Types: R. Fraser.

Mr. Fraser exhibited a model of the benzene molecule as conceived by Langmuir, and demonstrated how it accorded with known facts of substitution.

THE FARADAY SOCIETY.

At the annual meeting held on December 13, the officers and ordinary members of Council for the ensuing year were elected as follows:—President: Prof. A. W. Porter; past-presidents: J. Swinburne, Sir R. T. Glazebrook, and Sir R. Hadfield; vice-presidents: W. R. Cooper, Prof. C. H. Desch, Prof. F. G. Donnan, Dr. J. A. Harker, E. Hatschek, Prof. T. M. Lowry, and Dr. G. Senter; treasurer: Robert L. Mond; Council: Prof. A. J. Allmand, Dr. H. Borns, Cosmo Johns, Prof. J. R. Partington, C. C. Paterson, Dr. J. N. Pring, Prof. W. C. McC. Lewis, Prof. A. O. Rankine, Dr. E. K. Rideal, and Sir R. Robertson.

The annual report presented to the meeting states that during the past year four General Discussions have been held, of which three were in conjunction with other societies, and that the published reports of these are in good demand. The work of the Society has greatly expanded and a larger membership is looked for in order to enable the Society to keep pace with its increased activities without raising the annual subscription.

A paper "On the Structure of some Gaseous Molecules of which Hydrogen is a Constituent" was read by Prof. A. O. Rankine, of which the following is the author's summary:—

(1) Various molecules containing different numbers of hydrogen atoms are considered from the point of view of their behaviour in molecular collision, and tables are given of the "mean collision areas."

(2) Assuming that the atoms towards the end of each period of the periodic table are equal in size (evidence in support of this is given), it is shown to be probable that as the number of hydrogen atoms in the molecule increases, their nuclei get more and more remote from the nucleus of the central atom.

(3) It is suggested that this retreat of the hydrogen nuclei is due to their mutual repulsion, and that the effect eventually leads to the failure to form such molecules as BH_5 and AlH_5.

(4) A comparison is made of the relative dimensions of CH_4 and Kr, which prove to be of the same size to a degree within that of probable experimental errors. The identity of correspondence between CH_4 and NH_4, as compared with that between Kr and Rb, is pointed out, and attention is drawn to the equality of domains occupied in corresponding crystals by NH_4 and Rb respectively. The results of estimates of molecular dimensions derived from viscosity measurements and from crystal measurements thus mutually confirm one another.

SOCIETY OF GLASS TECHNOLOGY.

At the forty-eighth general meeting, held in University College, London, on December 14, Dr. M. W. Travers presided and three papers were read.

A paper on "A Suggested Method of Investigating the Viscosity of Glass," by Dr. I. Masson and Messrs. N. F. Gilbert and H. Buckley, was read by Mr. N. F. Gilbert. The method employed consisted in dropping a sphere of platinum or nickel into molten glass contained in an alundum crucible, measuring the time of fall, and applying a modified form of Stoke's law to calculate the viscosity.

Mr. V. Stott, of the National Physical Laboratory, read a "Note on Pipettes," in which he urged that they should be tested for both delivery-time and capacity, and that a definite period should be allowed for drainage both when graduating and using them.

Mr. F. Twyman, in a paper "On the Annealing of Glassware and on Annealing without Pyrometers," discussed the difficulties involved in determining the annealing temperature of a glass from its viscosity, and proposed a method which obviated them. This method was based on Maxwell's expression for the removal of strain in viscous solids, the principle being that if, during annealing, the proportion of stress left in the glass (compared with that present before the process commenced) is observed from time to time, the process can be stopped when that proportion was sufficiently small, *e.g.*, 1/10 or 1/20. The practical approximation to this is attained by putting into the furnace with the glass to be annealed a piece of the same glass that is elastically strained by a definite amount. The stress is removed periodically and the piece allowed to spring back to its original shape. As the temperature of the furnace is raised the time comes when the test-piece does not spring back entirely, and then from observations of the time the glass was kept under strain and the extent to which it recovered its original position, it is possible to calculate the time of relaxation. Practically, this is not necessary, for if the piece spring back, *e.g.*, by one-half of the original distance of strain, it is known to be half-annealed, or if by one-tenth, 90 per cent. annealed, and so on. If the test-piece deliberately strained is annealed, then the other objects which passed through the same temperature-range and were originally strained by want of annealing will become annealed simultaneously to the same degree.

CORRIGENDA.—In the issue for Dec. 15, p. 448R, col. ii., l. 3 from bottom, for "600° C." read "over 160° C."; p. 449R, col. i., l. 16, for "bottle-glass" read "lampworking glasses," and l. 18, for "bottles" read "glasses."

NEWS AND NOTES.

CANADA.

The Tar-Sands in Alberta.—The bitumen obtained from the tar-sands of McMurray, Northern Alberta, was recently subjected to large-scale tests and yielded 18 per cent. of gasoline, 13 per cent. of kerosene, and 53 per cent. of lubricating oils.

The Alberta Press reports that a number of oil experts and capitalists in Canada, California, and Texas have formed a company to develop these tar-sands and to erect a refinery for the production of gasoline, illuminating gas, lubricating oils, and asphaltum. The company has obtained control of 6000 acres of sand near Fort McMurray.

Steps are being taken to establish a coal-briquetting industry in Edmonton district, Alberta, and possibly in other parts of the province. It is understood that estimates are being obtained of the cost of machinery for the initial plant, and that they will be laid before the coming session of the provincial legislature. It is proposed to utilise the asphaltic base of the Athabasca tar-sands as a binder for the briquettes, which will be made from the slack, low-grade, and disintegrating coals of the province (*cf.* J., 1921, 406 R).

The Compressed Gas Industry in 1918.—The bulletin of the Dominion Bureau of Statistics upon the compressed gas industry of Canada for the year 1918 states that there were 14 plants engaged in producing 5,484,755 cb. ft. of acetylene, dissolved in acetone, valued at $138,881; 33,880,000 cb. ft. of oxygen at $674,693; and 2,742,632 cb. ft. carbon dioxide at $221,001. The value of the by-products was $13,696. Seven plants compressed both acetylene and oxygen, three acetylene only, and four carbon dioxide. The provincial distribution of the factories was as follows:—Nova Scotia 2, Quebec 3, Ontario 3, Manitoba 4, and 1 each in Alberta and British Columbia.

The total sum invested in these plants was $1,736,193, the value of lands, buildings, and equipment was $793,278, and the average number of persons employed 170. The raw materials cost $89,042, and the products had a value of $1,048,271. The salaries paid were $105,776, and the wage-earners received $192,622; miscellaneous expenses (rent, power, insurance, etc.) were $148,940. Thus the earnings of the industry amounted to $506,262, or slightly more than 28 per cent. on the capital invested. Nearly all the oxygen was made by the air-liquefaction process, the acetylene from carbide, and carbon dioxide from the combustion of coke. Electrical power was mainly employed. Chlorine gas is made at a number of plants for bleaching and purifying water, and hydrogen for hydrogenating oils, but these are not dealt with in the report.

FRANCE.

Industrial Notes. — *Chemical Industry.* — The general tone of the chemical market is good, and there is great activity in the works producing heavy chemicals, hydrochloric acid, in particular, being in short supply. Stocks of nitrate of soda remain unsold and a heavy fall in price is expected which will bring down the prices of other fertilisers. The price of ammonium sulphate has now risen to 100 francs per kg. for the extra-dry quality, and if the rise continues the demand will probably cease.

The Société Kali Ste. Thérèse has petitioned the court at Mulhouse to order the liquidation of the "Comptoir" for the sale of Alsatian potash.

Metallurgy.—The improved demand for metallurgical products continues, and production would be greater but for the deficient railway transport. The shortage of metallurgical coke is also due to this cause and not to any unwillingness on the part of Germany to supply the quantities agreed upon. The stipulated supply of German coke was 15,000 metric tons, but in October it fell to 500 t., afterwards rising to 12,000 t. During the period January—September, 1921, France, including Lorraine, produced 10,579,000 t. of iron ore, of which more than one-half came from the Metz-Thionville field; in the same period 2,510,000 t. of pig iron was produced, compared with 5,207,000 t. (exclusive of Lorraine) in 1913. The supply of iron ore to Germany has been restarted, and in October it reached 200,000 t.

The proposed agreement between France and Germany by which Germany would pay part of the war indemnity in kind for the reconstruction of the devastated areas has been accorded a very mixed reception in industrial circles (*cf.* J., 1921, 349 R). Producers of raw metallurgical products are in favour of the agreement because they think it would enable them to obtain an abundant and cheap supply of coke from the Ruhr district and to sell to Germany their surplus iron ore, pig iron and semi-manufactures. On the other hand, French firms which manufacture finished iron goods, constructional materials, etc. suggest that orders for material should be given to Germany only if approved by a committee of French constructors, and if French firms cannot deliver the goods at competitive prices.

Coal.—In face of increasing competition from English and Belgian coal, the French coal industry will be forced to reduce prices. Owners and miners have already provisionally agreed on a reduction in wages, but measures must also be taken to reduce profits and to increase output. Imports of coal during the first nine months of 1921 totalled 10,175,000 t., and exports only 37,000 t. (Belgium 12,000 t., Switzerland 16,000 t., and Italy 2800 t.). The output of coke during the same period was 562,000 t., or about 58,000 t. a month, which compares with 145,000 t. a month in 1913. The dependence of France on producers in the Ruhr district is unsatisfactory.

The Glass Industry.—The French glass industry is gradually recovering and is now able to hold its own in the manufacture of rough glass, window glass, and coloured glass. The imports and exports, which were 5020 and 13,962 metric tons, respectively, in 1913, were as follows in 1920:—

	Imports.	Exports.
	Metric tons.	
Rough glass, rolled or moulded	22,624	463
Window glass	41,893	5,826
Totals	64,517	6,289

During the first five months of 1921 the imports and exports were 5932 and 2119 t., respectively. Glass for electrical purposes is manufactured at Choisy-le-Roi in modern plants which produce 40,000 electric lamps a day, together with large quantities of glass globes and reproductions of works of art. The Garchey process for producing glass-stone by melting and compressing broken bottle glass is now used by four large plants. Glass-stone, besides being used for domestic decoration, is a perfect paving material, for which purpose it has been utilised in Geneva for the past three years.—(*U.S. Com. Rep., Oct.* 10, 1921.)

JAPAN.

Sugar Production.—According to the *Weekly Statistical Sugar Trade Journal* the output of sugar in Japan in 1920–21 was 342,176 tons, comprising 251,551 t. Formosa centrifugals, 15,625 t. Formosa browns, and 75,000 t. inland, black and centrifugals (final figures). The estimated crop for 1921–22 is 446,875 tons, an increase of 30 per cent., made up of 343,750 t. Formosa centrifugals, 21,875 t. Formosa browns, and 81,250 t. inland, black and centrifugals.—(*Ind. Tr. J., Oct.* 20, 1921.)

AUSTRALIA.

Bauxite for Aluminium Production.—Inquiries are being made by the Commonwealth Bureau of Commerce and Industry concerning the possibility of producing aluminium on an industrial scale. Of the various deposits of bauxite now being investigated the best have an aluminium content equal to that of imported American ore. The deposits in the Wingello district, New South Wales, have attracted particular attention, and the Director of the Bureau states that efforts are to be made to interest some of the steel-manufacturing companies in the proposal to exploit them. Already 4 million tons of ore has been proved at Wingello, and it is probable that many times this quantity is available. The ore assays 40 per cent. alumina, 35 per cent. iron oxide, and 25 per cent. combined water. The recovery of both aluminium and iron from the Wingello ore seems practicable, but would depend upon a supply of cheap hydro-electric power, which is not yet available.

Bauxite is also found at Narracan, Victoria, where it has an alumina content of 52—59 per cent. (35—37 per cent. extractable); it is already being used in the manufacture of aluminium salts, but as a source of alumina it is apparently less suitable than the Wingello ore. The bauxite of the Darling Ranges, W. Australia, has an average content of 35 per cent. alumina, but varies widely in composition and is high in impurities. There are bauxites of almost every grade in the New England field of N.S. Wales, but no large deposits with a high alumina content have been proved. At present only the Wingello deposits appear to be commercially suitable for the production of aluminium.

Production of Minerals and Metals in Tasmania in 1920.—The report of the Acting Secretary of Mines for Tasmania states that the value of the minerals raised in 1920 was £1,421,104, or £120,014 more than in 1919. There were marked increases in the production of lead and osmiridium, smaller increases in silver, copper, and coal, but declines in tin, wolfram, iron pyrites and scheelite.

		Amount.	Value. £
Gold	oz.	6,365·045	.. 29,796
Silver	,,	623,359	.. 166.767
Osmiridium ..	,,	2,009·196	.. 77.114
Lead	tons	3,856	.. 142,268
Copper	,,	4,792	.. 528,237
Tin	,,	1,310·4	.. 369,362
Zinc	,,	9·3	.. 334
Scheelite ..	,,	105·1	.. 17,905
Iron pyrites ..	,,	440	.. 7,346
Barytes	,,	1,048	.. 4,163
Coal	,,	75,429	.. 64,005

—(*Ind. Aust., Sept.* 15, 1921.)

UNITED STATES.

Bauxite and Aluminium in 1920.—*Bauxite.*—The quantity of this mineral marketed in the United States in 1920 was 521,308 long tons, or 38 per cent. more than in 1919, the main increase being in the Arkansas field (44%). A total of 383,154 t. of bauxite was used for making aluminium, 85,878 t. for chemicals, and 52,276 t. for abrasives. Imports amounted to 42,895 t., including 29,399 t. of calcined bauxite from British Guiana; exports were 22,257 t., and the apparent domestic consumption was 541,946 t.

The world's output of bauxite in 1920 was:—United States 529,675 metric tons, France 186,693 t., Italy (including Dalmatia and Istria, 33,860 t.) 37,960 t., and the United Kingdom 11,197 m. t.

Aluminium.—The production of aluminium in the United States in 1920 was valued at $50,864,100, the imports at $13,077,022, an increase of over 4·5 million dollars, and the exports at $5,630,781, a gain of nearly 4 million dollars. The apparent consumption was $58,310,341, an increase of about 7 million dollars. Plant capacity has continued to expand owing to the development of hydro-electric power near Maryville, Tenn., and Badin, N.C. The Anaconda Copper Co. began to produce aluminium early in 1921, but not on a commercial basis; and it is reported that a company in San Francisco proposes to develop extensive water-power on Klamroth River to be used for producing aluminium. In France, the Cie. d'Alais has purchased the Société Electrométallurgique Française, and the combination, which has a capital of 130 million francs, will control 90 per cent. of the French producing capacity, besides holding important interests in the Italian and Norwegian aluminium plants. The Norwegian production was 3120 metric tons in 1919, as compared with 6834 t. in 1918 and 7600 t. in 1917. It appears that the extraction of aluminium from labradorite in Norway (*cf.* J., 1919, 87 R) is not yet a commercial success. Production in Germany is probably above 25,000 t., and in Italy it was 1675 t.

Aluminium Salts.—There was an increase of 15 per cent. in the quantity of aluminium salts marketed in the United States in 1920, as compared with 1919, the total being 258,009 short tons; chloride, made at three plants, amounted to 3571 t., a decrease of 26 per cent., and sulphate (marketed), at 18 plants, 229,888 t., or 18 per cent. more than in 1919. Six municipal water-works made 4115 t. of sulphate for their own consumption; two more water-works are stated to be undertaking the manufacture.—(*U.S. Geol. Surv., Aug.*, 1921.)

GENERAL.

The Safeguarding of Industries Act.—Those who have striven to express their thoughts in precise and perspicuous English know well the difficulties arising from the existence of words that have more than one meaning, and even of words that have no precise meaning at all. The history of thought abounds in instances of terms whose connotations have altered, although the words themselves have remained unchanged; and the history of chemistry is no exception to this rule (*e.g.*, *element*, *atom*, *oxidation*, *combustion*, *acid*). It can, therefore, not be disputed that an accurate knowledge of the meanings of words, if slightly less important than an accurate knowledge of things or phenomena, is of the greatest value to the man of science as well as to the man of letters.

The recent proceedings before the Official Referee under the Safeguarding of Industries Act have brought into bold relief the importance of clear and precise phraseology in law, in trade, and in science. Unfortunately, in drafting the Act no attempt was made to define, even by description or illustration, the meanings to be attached to the terms employed, and the long and costly actions that are resulting are in no small measure due to diversity of opinion concerning their signification. It is noteworthy that the disagreement is not confined to words that are exclusively used in trade, industry, or every-day life, such as *chemical*, *fine chemical*, and *manufactured*, for there is also a lack of unanimity concerning the meanings of such words as *organic*, *synthetic*, and *derivative*; and it appears that some of the witnesses, justly respected as eminent investigators, and authorities on theoretical and experimental chemistry, had not previously realised the necessity for expressing in terms "understanded of the people" the precise meanings of certain words which are constantly on their lips; and the confusion has been added to by the partial inability, through ignorance of the science, of the legal mind to understand the proffered explanations. It is also unfortunate that the Referee is bound to base his decisions almost entirely upon the letter of the law and not to invoke its purpose except as a last resort.

In the absence of any body, scientific or literary, in this country comparable with the *Académie Française*, whose rulings upon the use and meaning of words are authoritative, the only course appears to be to invite the expression of expert opinions upon the connotations of the terms under discussion, and to leave it to those more immediately concerned to sort and sift them, with the object, and in the hope, of arriving at a definitive meaning in each case, even if it be only a pragmatic or "working" one.

The suggestion is therefore put forward that this Society, through its numerous Local Sections, should endeavour to assist by organising meetings to discuss on a strictly scientific basis the terms *chemical, fine chemical, manufactured* (*cf.* report of Santonin case, p. 473R of this issue), *organic, synthetic, derivative.* If the Sections would take up this matter without delay, it is felt that the information obtained would not only be interesting and instructive to chemists of all shades, but might also be valuable to those who make, draft, and administer our laws.

Photosynthetic Processes in Nature.—Prof. Benjamin Moore's lecture to the Chemical Society on this subject is published in the October issue of the Society's *Journal.*

In the continuous progression from the inorganic world right up to man, the critical stage is the gradual building up of organic colloids which react to light and give rise to living matter at a much lower level than that of bacteria or amœbae. The growth of algae in the sea in spring is not due to the rise in temperature, but to the penetration of light which precedes that rise, and the curve of growth closely follows the curve of sunshine. This outburst of life is accompanied by an increase in the alkalinity of the water. Higher plants, however, do not give out alkali to the surrounding medium; they keep a supply in their tissues which is used over and over again in fixing free carbon dioxide from the air.

Under the influence of sunlight algae not only utilise nitrites and nitrates in building up organic nitrogenous compounds, but also the free nitrogen of the air, and as atmospheric carbon dioxide and water are also available, the green cells of many, and perhaps most, plants are able to synthesise from the atmosphere alone such intricate substances as proteins, fats, and carbohydrates. The synthetic action varies with the wave-length of the light affecting the organism. One function of the chlorophyll of green leaves may be to act as a screen against harmful rays which would otherwise destroy the sensitive plant-cells. Under the influence of sunlight nitrates taken up from the soil are changed into nitrites, which are much more active physiologically than the nitrates, and protein formation is thus facilitated. Formaldehyde, though generally very poisonous to cell life, can be utilised under certain conditions and built up into complex organic substances for the use of the plant.

Production of Bauxite in Germany.—The only bauxite deposits now being worked in Germany are those in Hesse, belonging to the Bauxitwerke A.-G., of Giessen, which produces roughly 1000—1200 metric tons per month from 15 quarries. The mineral is sold chiefly to the State Lautawerke for the production of aluminium, but it is also sold to producers of emery and aluminium salts. There is no obstacle to increased production, except the present state of trade, and in the coming year an output of 20,000 t. is expected. The industry receives much support from the Hessian Government.—(*Chem. Ind., Oct.* 24, 1921.)

The Bavarian Graphite Industry.—The depreciation of German currency has proved very beneficial to the graphite industry of the Passau district of Bavaria. At present Bavarian graphite is cheaper than that from Ceylon or the United States, and the Malagasy product, although cheaper, cannot compete on account of the difficulty of separating its mica content. The Bavarian producers can now deliver graphite suitable for preparing crucibles, lead-pencils, lubricants, dynamo brushes and electrodes. Recently Bavarian graphite has been used successfully for making muffles, refractory bricks, washkettles, as a backing for mirrors, and for paper insensitive to light.—(*Schweiz. Chem.-Z., Oct.* 11, 1921.)

The Partition of Upper Silesia.—The effect of the recent partition between Germany and Poland of the disputed districts in Upper Silesia is to transfer the major part of the chemical industries in those districts to Poland, as may be seen from the following statistics of production for the year 1913:—

Production of:	Districts ceded to Germany.		Districts ceded to Poland.	
	Amount in 1,000 m. tons.	Value in mill. mk.	Amount in 1,000 m. tons.	Value in mill. mk.
Coal	10,297·8	95·9	32,506	292·3
Iron ore	4·2	0·02	130	0·9
Zinc ore	94·3	5·5	426·8	24·7
Lead ore	15·3	1·6	37·3	5·0
Sulphur ore	5·7	0·07	2·0	0·03
Coke	1,118·9	17·4	1,146·3	17·0
Coke by-products ..	81·5	7·9	82·1	7·3
Zinc	—	—	167·9	73·8
Zinc by-products ..	—	—	8·7	3·8
Lead	—	—	39·9	14·7
Silver	—	—	738·5 kg.	0·6
Sulphuric and sulphurous acids ..	—	—	163·0	4·3
Petroleum products..	1·8	0·6	1·4	0·2
Products of coal-distillation ..	30	1·0	92·8	—

These figures show that the whole of the producing capacity for zinc and lead and their by-products will fall to Poland, together with 96·9, 81·9, and 70·9 per cent., respectively, of the output of iron, zinc, and lead ores. Germany retains 56·2 per cent. of the plant for refining petroleum, and about 50 per cent. of the productive capacity for coke and its by-products.

Production of Gold and Platinum in Russia.—The output of gold in Soviet Russia was 74·42 kg. in April, and 34·26 kg. in May, 1921. These figures are 40 and 15 per cent., respectively, of the estimated minimum production. In the same months there were produced 630 gm. and 19·4 kg. of platinum, representing 2·7 and 70 per cent. of the estimated totals. Before the war the yearly production of platinum was about 4900 kg. It is reported that the Workers' Council has decided to transfer the control of stocks of gold and platinum in Soviet Russia to the Mining Council so that there can be a check on the stocks of, and profits made from, these metals.—(*Edel-Erden u. -Erze, Nov.*, 1921.)

The Russian Beet-Sugar Industry.—At one time the production of beet sugar in Russia amounted to 2 million tons in one year, and in 1911-12 the export alone was 570,000 tons. Since then the output declined from 1,740,000 t. in 1914 to 914,000 t. in 1917, and to 90,850 t. in 1920. An increased area was planted for the 1921 season, but the estimated production, 163,000 t., would not meet one-half the requirements of the population. No great increase can be expected, as it is impossible to repair the sugar-making machinery, much of which is useless, and labour, fuel, seed, and manure are lacking. The loss of the rich sugar lands of Poland was a heavy blow to the Russian sugar industry, but the disorganisation of industry has proved far more disastrous (*cf.* J., 1919, 378 R).—(*Ind. Tr. J., Aug.* 18, *Oct.* 6, 1921.)

Sugar Production in Belgium.—The Belgian production of raw sugar in the years 1918–19, 1919–20, and 1920–21 (September—June) was 73,835 long tons, 146,604 t., and 242,360 t., respectively. In 1913–14 the production was 226,660 t. Stocks at July 1, 1921, amounted to 60,230 t., compared with 41,695 t. twelve months previously.—(*Ind. Tr. J.*, *Oct.* 20, 1921.)

Chemical Industry in Yugoslavia.—Wood-distillation is the most important chemical industry in Yugoslavia, and its products constitute the most valuable item in the list of exports. The industry is located mainly in Croatia-Slavonia and Bosnia The chief undertakings in the former province are the S. H. Gutman A.-G., of Belisze (capital 30 million kronen), which produces 10,000 metric tons of oak extract per annum; the Neuschloss'sche Nasicer Tannin- u. Dampfsäge A.-G. (10 mill kr.), the Slavonia Holzindustrie A.-G. in Brod (6 mill. kr.), and the Holzexploitations A.-G. (3·6 mill. kr.). In Bosnia are located the Sumsko Industrialno Preduzece Dobrlin-Drvar (6 mill. kr.), which also owns a cellulose factory, and the Bosnische Holzverwertungs A.-G. in Teslic (1·8 mill. kr.), which produces methyl alcohol, acetate of lime, wood tar and wood charcoal. In Montenegro and S.W. Croatia sumac wood with 10—20 per cent. tannin is obtained and exported, chiefly as extract, to Italy; gallnuts are also exported. The total production of tannin in Yugoslavia is estimated at 6300 wagon-loads, of which 1100 is utilised in the country. One of the most important firms is the Bosnische Elektrizitäts A.-G. in Jajce (9 mill. kr.), which manufactures calcium carbide, chlorine and its derivatives, caustic soda, and ferro-silicon. The largest chemical undertakings are situated in former Austro-Hungarian districts; these include the Schwefelsäureindustrie u. Kunstdüngerfabrik Danica, Kobrivnica (6 mill. kr.), the Isis-, Drogen- u. Chemikalienindustrie u. Verkehrs A.-G., Agram (4 mill. kr.), the Erste Bosnische Ammoniaksoda-Fabrik A.-G., Lukavac, near Tuzla (4.5 mill. kr.), A factory in Hrastnig produces yearly 2000 wagon-loads of fertilisers and 500 of sulphuric acid; and there are numerous other sulphuric-acid works. At Belichte, near Aussig, there is a yearly output of 7000 metric tons of wood charcoal, 4200 t. acetic acid, 1300 t. tar products, 1600 t. methyl alcohol, 1200 t. acetone, 900 t. formaldehyde, and 500 t. sodium acetate.

Tar products are manufactured at Fiume and Agram, soap is made at Nish and in other centres, a large plant under construction at Borowo, near Bucowar, is to produce glycerin, and a soap and perfume factory is being built with French capital at Semlin. The alcohol and starch industries are also important. The formation of the Yugoslavische Petroleum A.-G., at Agram, with the help of English capital, and of the Petroleum Handels A.-G. Slavia in Belgrade, should assist the development of the country's rich resources of petroleum; hitherto there has been only one refinery, in Brod. The possibilities of the chemical industry in Yugoslavia are very great, and the country offers a good market for foreign products.—(*Chem. Ind.*, *Aug.* 8, 1921.)

The Oil-Shale of Esthonia.—The oil-shale deposits of northern Esthonia cover a large area and are being rapidly developed, especially in the area between Rakvere and Johvi adjacent to the Reval-Narva-Petrograd railway. Investigations conducted by the Esthonian Government indicate an unbroken and nearly horizontal layer of oil-shale about 1.75 m. thick and 230 kilom. long at a depth of about 3 m. The centre of the industry is Kohtla, 150 kilom. from Reval. The mine produced last year 2¼ million pouds (40,300 long tons) of shale, and this year the production will probably be doubled. The Esthonian Government has one Pintsch retort in operation and several more retorts are being set up. The shale has a calorific value of from 4200 to 5500 calories and yields on distillation from 20 to 30 per cent. of oil. This oil consists of one-fifth benzine, one-fifth burning oil, one-fifth lubricating oil, and two-fifths tar or pitch. Phenol, naphthalene and ichthyol are also present.

All the oil shale of Esthonia belongs to the State, which now employs about 1000 men in the industry, but the field is also open to domestic and foreign capital. Under an Act passed last year a concessionnaire can obtain 350 hectares (nearly 900 acres) of oil-shale land for exploitation and the building of a factory, with the privilege of taking up within a specified time 200 hectares of adjoining land if he desires to do so. Many such concessions have been granted, but so far little or no work has been done upon them. Lately a much larger concession—10,000 hectares—to run for 50 years was given to a Franco-Belgian syndicate, which aims at a daily output of 7000 tons of distilled oil.—(*Times Eng. Suppl.*, *Nov.*, 1921.)

The Nickel Industry in New Caledonia.—H.M. Consul at Nouméa reports that as there is no market for nickel at present most of the nickel mines in New Caledonia have been closed down or their production reduced. The Société le Nickel, of Paris, and the Société des Hauts Fourneaux de Nouméa are still working their mines and a little work is being done at the Maçonnaise and Gracieuse mines at Dumbéa, near Nouméa. The two first-named companies own large areas of undeveloped mining land and also nickel-smelting works. A large hydro-electric plant with a capacity of 30,000 h.-p. is being erected at Yate for the Société le Nickel (*cf.* J., 1921, 411 R) and a nickel-smelting plant, erected at Nouméa by a Japanese company, has not yet begun operations. Exports of ore and matte from New Caledonia have been as follows:—

	Ore.	Matte.
	Metric tons.	
1913	93,194	5.893
1914	94,154	5,287
1915	48,576	5,529
1916	30,679	4,935
1917	32,018	6,319
1918	15,612	3.938
1919	1,561	3,813
1920	3,246	4,508

The reduced export of ore is due to the development of local smelting plants, which will soon absorb the whole production. In recent years France has taken practically all the ore, and the United States most of the matte.—(*Bd. of Trade J.*, *Nov.* 3, 1921.)

PERSONALIA.

The University of Calcutta has conferred the degree of Doctor of Science, *honoris causâ*, upon Sir William Pope.

Dr. R. H. A. Plimmer has been appointed to the chair of chemistry in the University of London, tenable at St. Thomas's Hospital Medical School.

Prof. S. P. L. Sörensen, director of the Carlsberg chemical laboratory in Copenhagen, has been elected a member of the Academy of Sciences at Stockholm.

Prof. H. B. Dixon has announced his intention to retire at the end of the current session from the Sir Samuel Hall chair of chemistry in the University of Manchester to which he was appointed on the retirement of Sir Henry Roscoe in 1886.

We regret to record the death of Sir Charles H. Burge, aged 75 years, who joined the Society in 1898. The deceased was on the staff of the Government Laboratory from 1867 to 1907 and rose to the rank of Deputy-Principal. He was Mayor of Kingston for seven successive years, and took an active part in various war charities, for which he was knighted in 1918.

LEGAL INTELLIGENCE.

Appeal to Exclude Santonin from the List of Articles Dutiable under the Safeguarding of Industries Act.

This appeal was heard by Mr. Cyril Atkinson, the referee, on November 26 and December 3, and his decision was given on December 10.

Mr. K. Swan, counsel for the appellants (the Eastern and Russian Trading Co., Ltd., and the Chemical Merchants' and Users' Committee of the London Chamber of Commerce), explained that santonin was extracted from a plant found in South Russia and Turkistan; that the Germans controlled the market before the war, but England was now the chief distributing centre. He submitted that as santonin is not a synthetic, but a natural product, it is definitely excluded, since the organic compounds specifically mentioned are synthetic organic chemicals; and that it did not come within the group "all other fine chemicals" because that expression excludes alkaloids, essential oils, extracts, and medicinal preparations.

Mr. E. J. Parry said it was impossible to define precisely the terms "chemical," "organic," and "fine," but he took the word "chemical" to mean a body which had either been brought into existence by chemical action or was used as a chemical agent for the purposes of chemical reaction. Synthetic camphor was a chemical, but Japanese camphor was not because it was a natural product. Santonin was extracted by a process which did not require very skilled supervision, and it could not be prepared synthetically; if it could be so prepared it would fall within Group 1 of the Schedule. The fact that use was made of chemical actions in extracting santonin from the plant did not make it a chemical. If the alkaloid quinine were properly described as a fine chemical, then santonin was also a fine chemical, but he differentiated between the alkaloid and its salts (which were fine chemicals). The term "fine chemical" was a loose one, but it connoted most of the following attributes: it required considerable skill to manufacture; it was usually very pure; it was dealt with in small quantities; and it was expensive.

Mr. M. Salamon defined a chemical, from the purely scientific standpoint, as an individual substance of definite and unvarying composition and constitution, but agreed that from the general point of view Mr. Parry's definition could not be bettered. The word "synthetic" as applied to an organic substance meant "a laboratory-created replica of a naturally-occurring organic individual of either vegetable or animal origin; and a "fine chemical" was "a laboratory-produced material or chemical which was not a replica of a naturally occurring chemical." Santonin was not a fine chemical.

Dr. J. J. Fox, of the Government Laboratory, regarded alkaloids as of the very essence of fine chemicals. Santonin was certainly not an alkaloid, but it was a fine chemical. In general the term "fine chemical" was used in contradistinction to that of "heavy chemical," which was a commercial product, made on a large scale, and frequently very crude. A chemical was a reactive material.

Mr. F. H. Carr stated that the process of manufacturing santonin required intimate skill and supervision. Santonin was unquestionably a fine chemical. A chemical was either a pure element or a combination of elements which can be shown to have a uniform composition and identity and not be separable into two or more different substances except by chemical action. He did not agree that the term "chemical" connoted production by an artificial process; nor did it connote any use to which the substance might be put.

Mr. J. F. Ronca, principal staff officer of the Department of Industries and Manufactures of the Board of Trade, said the word "chemical" was not a scientific term; chemists used the terms "element" and "compound." The Board used it in its general sense, viz., as a prepared reactive substance, and not necessarily chemically reactive, and which, generally speaking, had a single identity. This definition excluded minerals like barytes because they were not prepared substances. The term "fine chemical" was equally unscientific; in general it covered all substances which were not heavy chemicals, but there were border-line cases to which special tests had to be applied, *e.g.*, the amount of skill required in preparing the substance, and the scale upon which it was made. The amount of skill needed to prepare santonin made it a fine chemical. A "key" industry was one which produced something essential, and the Board did not regard the manufacture of individual products as an industry in the sense of the Act. The Act covered that part of the chemical industry which was not included in the heavy-chemical industry. Comparatively rare substances such as santonin could not be manufactured in competition with the world unless there existed an organisation and plant comparable with those in other countries.

Mr. Whitehead, counsel for the Board of Trade, said there was probably no article mentioned in the Schedule which could not be applied to further use. Complainants' case was: (*a*) santonin was not a chemical; (*b*) if it were a chemical, it was not a fine chemical; and (*c*) if it were a fine chemical, it was not a fine chemical within the meaning of the Act. Santonin was not excluded from being a chemical because it was a drug or because it was produced by an extraction process, and the latter involved several changes. Santonin was a reactive substance. If it were admitted to be a fine chemical there was no valid legal argument against its inclusion in the Schedule; in drawing up the latter the Board had not considered the purpose of the Act as that had been considered by Parliament.

Mr. Atkinson, in his decision, said the first step was to ascertain the sense in which the word "chemical" was used in the Schedule. Five eminent chemists had given evidence, but they all defined the word differently. Mr. Carr's definition would include such substances as sugar, starch, and water, and he was sure that this was not the sense intended. Mr. Ronca's expression "reactive" was very vague; and he thought that the Legislature never intended to tax a process of extraction, especially if that process could not be carried on in this country. He held that the word "chemical" in the Schedule was used as applying to a substance manufactured by a chemical process, and he therefore accepted Mr. Parry's view on that point. He also preferred Mr. Parry's view that a chemical was a substance primarily used for the purpose of chemical reaction. Santonin was neither a substance manufactured by a skilled chemical process nor a substance primarily used for the purpose of a chemical reaction. Even if he thought that santonin was a chemical, he would have great difficulty in regarding it as a fine chemical, and he doubted the practicability of classifying chemicals into "heavy" and "fine." He held that santonin had been improperly included in the list because "it is not a chemical in the sense in which that term is used in the Schedule, inasmuch as it is not brought into existence by a process of manufacture, nor is it used for the purposes of chemical reaction in any further chemical process or process of manufacture, or at all." He did not regret having been driven to this view because the taxation of santonin would benefit nobody, would protect no industry and safeguard no manufacture; it would merely raise the price of a very useful product.

After Mr. Atkinson had stated that he would not allow costs, Mr. T. Watson, for the Board of Trade, asked if he would state his award in the form of a special case, defining the terms "chemical" and "fine chemical." Mr. Atkinson said that he would not be inclined to do more than state a case so that it went before only one tribunal, but in that case he would have to reconsider the question of costs. He would prefer the Board to drop the application in the present case. Mr. T. Watson said he would not press it.

PARLIAMENTARY NEWS.

HOUSE OF COMMONS.

Safeguarding of Industries Act.

The following are summaries of answers given by the President of the Board of Trade to questions relating to the operation of the Act:—

Celluloid.—Although gas mantles are liable to an import duty of $33\frac{1}{3}$ per cent. on parts of the mantles, no such duty is to be applied to imported celluloid containing synthetic camphor.—(Dec. 16.)

Menthol.—Recrystallised menthol of better quality than the Japanese menthol ordinarily imported was listed in the English catalogue of a German manufacturer in 1911, and at least one English firm has been recrystallising menthol and selling small quantities in recent years. For this reason the letter R has been prefixed to menthol in the Board of Trade list.—(Dec. 16.)

Complaints.—All objections to the list must be lodged before January 7, 1922, and no extension of the period can be given. If the principle upon which the referee decided in respect of santonin be maintained, the list will be revised accordingly, and further representations could then be made.—(Dec. 16.)

Incandescent Gas Mantles.—Answering the assertions that Germany had doubled the import duty on gas mantles, that Parliament had decided against their inclusion in the first part of the Schedule, and that the imports of gas mantles from Germany in 1920 were 15 times greater than in 1919 and equalled the total home consumption, Mr. Baldwin stated that he was considering the referee's decision that gas mantles were liable to duty, and hoped to arrive at a conclusion at a very early date.—(Dec. 16.)

Schedule of Dutiable Goods.—All the amendments so far made in the lists of dutiable goods restrict the scope of the original lists. Corrections must necessarily be made in such lists, and there is no reason to change the procedure adopted. When the lists were compiled no assistance was asked from a Manufacturers' Association, nor was the Chemical Society or other independent body consulted.—(Dec. 16, 19.)

Imported Chemicals.—When it is doubtful if an imported chemical is dutiable under the Act, a sample is submitted to the Government chemist and an opinion obtained with the least possible delay. An importer can obtain immediate possession of the goods by depositing an amount sufficient to cover the duty if the goods are ultimately held to be dutiable. The expense of appointing expert advisers at the various ports cannot be incurred.—(Dec. 19.)

Indian Opium Trade.

Answering Mr. Gilbert, Col. Gibbs said that the opium poppy was cultivated over 156,435 acres in British India during 1919–20, and 9823 chests of opium were exported in that year.—(Dec. 16.)

OFFICIAL TRADE INTELLIGENCE.

(From the Board of Trade Journal for December 8 *and* 15.)

OPENINGS FOR BRITISH TRADE.

The following inquiries have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W. 1, from firms, agents or individuals who desire to represent U.K. manufacturers or exporters of the goods specified. British firms may obtain the names and addresses of the persons or firms referred to by applying to the Department and quoting the specific reference number.

Locality of firm or agent.	Materials.	Reference number.
Australia	China, glassware, enamelware	*
Canada	"Stainless" steel	497
,,	Artificial silks	499
,,	Printing paper	501
,,	"Stainless" iron	7308/E.D./ S.C. 2.
,,	Cold lacquer	519
,,	Tinfoil for wrapping, cocoa butter, colours, essences, etc., used in the confectionery trade	520
Belgium	Asbestos sheeting	13241/ F.W./S.C.2
Denmark	Rubber goods, steel wire, sheet lead, iron and steel, belting, asbestos, rubber and metallic packings	505
Holland	Corrugated, galvanised steel sheets	532
Hungary	Composition for construction of tar-macadamised roads	608
Italy	Coal	636
Poland	Copper and other metals	533
Rumania	Copper sulphate, mineral oils, fish oils, *degras*, balata and leather belting, tool steels, black sheets, tinplate, galvanised sheets, etc.	534
Spain	Coal	537, 538
,,	Ammonium sulphate	539
Switzerland	Metals, tinplate, galvanised sheets, refractory materials	512
Egypt	Printing ink, glue, starch (tender for)	6759/F.E./ P.N.
Argentina	Paper, sheet and plate glass, wire	544
Argentina Uruguay Brazil, Chile	Perfumery	546
Brazil	Iron and steel products, tinplate, lead, tin, zinc, copper, cement, chemicals (especially soda ash, caustic soda), lubricating oils, paints	547

* Official Secretary, Commercial Bureau, Commonwealth of Australia, Australia House, Strand, London, W.C. 2.

TARIFF. CUSTOMS. EXCISE.

Austria.—When paid in banknotes, the gold duties of the customs tariff are to be levied at 300 times the nominal rates. Artificial silk, certain wares of fine hollow glass, etc., have been removed from the list of goods on which duties are payable in gold.

Belgium.—Licences for the export of alcohol, yeast, and barm are not required after November 30.

Bermuda.—Imported opium must bear a certificate to show that it is intended solely for medicinal or scientific use.

Canada.—Revised regulations for the marking of imported goods have been issued. A copy may be inspected at the Department of Overseas Trade.

Denmark.—Increased import duties are payable, as from November 26, on "luxury" goods such as various raw skins, cut-glass ware, fine porcelain, wares of gold, silver and platinum, acetic acid and vinegar (when not for technical use), vanilla, vanillin, saffron and extracts thereof.

Ecuador.—The export of tague (ivory) nuts is prohibited if they contain 1 per cent. or more of red nuts. The export duty on rubber has been suspended.

Egypt.—The import tariff valuations on non-ferrous metals have been revised with effect as from November 1.

Federated Malay States.—As from October 20, duties on imported matches are fixed at $60 per case of 7200 boxes, and on imported petroleum and petroleum products at 10 cents per gallon.

Germany.—It is proposed to increase the customs duties on toilet soap, gas mantles, certain medicinal and pharmaceutical goods, rubber manufactures, paper, stoneware, earthenware, porcelain, glass, and wares of various metals. A list of goods for which export licences are no longer required is given in the issue for December 15.

Italy.—Imported electric-light bulbs and carbons for arc-lamps are to be subject to a surtax equal to the manufacturing taxes for the home-made articles.

Morocco.—Import duties on hides and skins, cocoa powder, drugs and chemicals, dye and tanning extracts, matches, soap, etc. have been increased as from January 1, 1922.

New Zealand.—Customs preference has been accorded to cream of tartar and its substitutes, operating from January 1, 1922.

Spain.—All restrictions on the exportation of olive oil have been withdrawn.

GOVERNMENT ORDERS AND NOTICES.

Safeguarding of Industries Act.—*Part I.*—As the Referee has given a judgment upholding the complaint under Section 1. (5) that santonin had been improperly included in the lists of articles dutiable under Part I. of the Act, the Board of Trade has withdrawn santonin from the lists as from December 20.

Part II.—The committee appointed to inquire into a complaint respecting domestic, illuminating, and mounting glassware is now considering mounting glassware and is prepared to receive further evidence. Communications should be addressed to the secretary of the committee, Mr. W. G. Fergusson, Board of Trade, Great George Street, London, S.W. 1.

A committee has been formed to consider a complaint that German gold leaf is being sold in the United Kingdom at prices below those at which similar goods can be profitably made in this country. The first sitting will be held at 2.30 p.m. on January 9, at 5, Old Palace Yard, Westminster, London, S.W. I.

The complaint relating to aluminium and enamelled hollow-ware, put forward by the British Aluminium Hollow-ware Manufacturers' Association, the Wrought Hollow-ware Trade Employers' Association, and the National Light Castings Association, has been referred to a committee constituted for the purpose, and the first sitting will be held at 2.30 p.m. on January 9, at 5, Old Palace Yard, S.W. 1.

Pollution of Rivers.—The Ministry of Agriculture and Fisheries has appointed a committee to investigate and report on the pollution of rivers, with Lord Ancaster as chairman and Mr. W. Prescott and Dr. J. T. Conroy as representatives of the Federation of British Industries. The first meeting was held on December 21, when the relevant clauses in the Salmon and Freshwater Fisheries Bill, which was introduced last session, were discussed. It is proposed to reintroduce the amended Bill next session.

REPORTS.

Rapport sur le Commerce et l'Industrie de la Suisse en 1920. *Pp.* 477. (*Zürich: le Vorort de l'Union Suisse du Commerce et de l'Industrie.* 1921.) *Published in French and in German. Price* 9 *francs* (*Swiss*).

This report of the Union Suisse du Commerce et de l'Industrie—the Associated Chambers of Commerce of Switzerland—contains a very complete record of the course of Swiss trade and industry during 1920. It is divided into two parts, the first comprising a general statistical review, and the second a detailed account of each branch of industry and commerce. The section on chemical industry covers 34 pages (10 × 8 in.) of which 16 are filled with statistics, detailed but very clear, of the import and export trades. As much of the information recorded in this section has already been noticed in abstract in these columns (*cf.* J., 1921, 70, 91, 130, 257, 317 R), only a few additional particulars need be given in this place, and attention directed to the special chapters dealing with paper, leather and rubber, metals, stone and cement, ceramics, coal, and electric-power supply.

Broadly speaking, economic conditions in Switzerland were good in the early part of 1920, they became less favourable towards the middle of the year, and by the end they were generally bad. The chief causes of the decline were world-wide in character, but Switzerland laboured under the special handicap of being unable to export freely owing to the high exchange-value of its currency.

In the heavy chemical industry, manufacturers of sulphuric acid had to contend with competition from Belgium, where there is always an exportable surplus; and it is probable that supplies will soon be even more abundant as two new factories were expected to start production during 1921; one of these is in Valais and belongs to the Société des Produits Azotés, and the other at Schweizerhalle, near Basle. Cheap hydrochloric acid was imported from Germany and in consequence there was a shortage of sodium sulphate. The nitric-acid industry suffered similarly from foreign competition and the two factories could only dispose of their output with difficulty Swiss soda sold well both at home and abroad, even in France, in the early part of the year, but when trade collapsed markets were lost to foreign producers, and but for the fact that the industry enjoys a State monopoly, home production would have ceased entirely. Supplies of raw materials for the fertiliser industry were no better than during the war, and Switzerland still only receives from France about one-third of her requirements in mineral phosphate. As the *Entente* countries are more favoured in this respect, Swiss manufacturers find it very difficult to compete with these countries, and especially with Belgium.

The crisis in the electrochemical and electrometallurgical industries which started in 1919 (*cf.* J., 1921, 154 R) became worse in 1921, and most of the factories either closed down or greatly curtailed production. Complete stagnation ruled in the carbide and cyanamide works. Production of carbide fell from 36,890 metric tons, worth 20,195,000 fr., in 1919 to 9890 t., worth 4,441,000 fr., in 1920; the home consumption was 3320 t. Production and sales of ferro-alloys also declined, but less seriously in the case of ferro-silicon and ferro-chrome Recent exports of crude ferro-silicon and other ferro-alloys and mean prices have been as follows:—1917, 22,780 t., 985 fr.; 1918, 15.670 t., 1130 fr.; 1919, 9740 t., 703·7 fr.; 1920, 6750 t., 487·5 fr. Exports to Germany have declined from 22,440 t. in 1917 to 3570 t. in 1920. The position in the electric iron and steel industry was a little less unfavourable.

The aluminium industry continued to suffer from scarcity of raw materials and foreign competition. The following table shows the imports and exports of aluminium into and from Switzerland in recent years:—

	Imports.	Exports.
	Metric tons.	
1913	600	7,490
1914	410	7,470
1915	120	9,410
1916	190	11,370
1917	440	11,130
1918	380	11,137
1919	1,080	6,120
1920	1,820	6,120

Factories producing chlorates were only partially employed and costs could hardly have covered expenses, but the manufacture of caustic soda and washing soda continued without interruption throughout the year, in spite of increased importations; profits, however, were lower on account of the enhanced cost of coal, raw materials, and wages. The production of chloride of lime was easily absorbed in the country and considerable quantities were sold to Italy and Germany, even in the second half of the year. Persulphates were not made, and the manufacture of hydrogen peroxide, which had continued for two years with fair success, was drastically reduced. Great efforts have been made to establish the manufacture of copper sulphate for use as a fungicide, and the Cie. des Produits Electrochimiques of Bex is producing it successfully from scrap copper, which after being subjected to various mechanical operations is converted into sulphate and purified electrolytically. Manufacture of nitric acid by the arc process proceeded practically without a break and the output was sold without difficulty. On the other hand nitrate of lime did not sell well, and it appears that the peasants object to handling the air-tight drums in which it is necessarily packed.

The manufacture of photographic plates was initiated during 1920 with very satisfactory results, and the country is now independent of foreign supplies. Both production and sales of synthetic perfumes attained a record, 320·6 t., worth 23,452,000 fr. being exported in 1920, as against 190·9 t., worth 13,160,000 fr. in 1919; at the end of the year, however, prospects were extremely bad. The market in pharmaceutical products followed the general course of trade, but with greater intensity, for prices were almost unprecedentedly high in the early months of the year and fell almost to a disastrous level at the end. The manufacture of many medicinal chemicals undertaken at great sacrifice during the war has been abandoned.

Report on the Financial and Commercial Conditions in the Republic of Honduras for the Year ended July 31, 1921. *By* G. Lyall, *H.M. Consul, Tegucigalpa. Pp.* 24. *Department of Overseas Trade. London: H.M. Stationery Office.* 1921. *Price 9d.*

Honduras, the second largest of the Central American Republics, is a very mountainous country rich in timber and mineral deposits. Industrial development has been hindered in the past by civil strife and bad transport facilities, but the year 1920—21 was marked by no active political unrest and the country profited accordingly. The chief agricultural industries are the cultivation of bananas, coffee, cotton, coconuts, and sugar, the first and the last of these being mainly owned by American interests. A large plantation of hennequen has been started near Nacaome and a concession has been granted to exploit the *coroze* or ivory nut in the northern districts. Stock-raising has been somewhat neglected, but the export of hides rose from 128 tons in 1919 to 419 t. in 1920. There are extensive undeveloped resources of mahogany, pines, and a great variety of hardwoods. Apart from silver, the exploitation of the country's mineral wealth has not been very successful. In April, 1921, the New York and Honduras Rosario Mining Co. closed down its gold and silver properties at Rosario, which have been worked for over 40 years, and the Sabana Grande Honduras Mining Co. ceased work at the San Marcos mine. The former company produced 1,711,349·4 oz. of silver and 8001 oz. of gold in 1920, and the exports from the country in that year included:—Silver bars, 62,926 oz.; silver, coined, 12,775 lb.; gold bullion, 156 lb.; silver and gold concentrates, 782,800 lb. Three British companies are prospecting for petroleum, although it is reported that the country was unsuccessfully explored for oil some years ago by large American interests.

The total value of the exports from Honduras in 1920 is estimated at £3,650,000, which is about 50 per cent. above the amount shown by the Government statistics; and that of imports probably around £3,800,000. Ninety per cent. or more of the total foreign trade is done with the United States. Trade with the United Kingdom is improving, but the market is limited owing to the proximity of the United States and to the small population (637,114 in 1920). Belgian concrete and German crockery and enamelware are quoted in Tegucigalpa at lower prices than similar goods from the United States.

Report on the Work of the Government Analytical Laboratory in 1920, and of the Assay Office in the Financial Years 1919—1920 and 1920—1921. *By* A. Lucas. *Ministry of Finance, Egypt. Pp.* 37. *(Cairo: Government Press.* 1921.) *Price P.T.*10.

The chemical work done for Government Departments by the Analytical Laboratory in 1920 was about equal in amount to that of 1919. There was some improvement in the quality of Government stores examined, gross adulteration being less common than formerly, but samples of really first-class quality were noticeably absent, and it appears that much low-grade material is still dumped into Egypt. An important part of the work of the chemical and physical staff is the drafting of technical clauses for specifications. The number of samples of cement investigated was more than twice that of 1919. Many proprietary articles for waterproofing cement were examined, and it was found that any slight improvement in the resistance to water was accompanied by a marked reduction in tensile and crushing strength. The quality of the paints submitted was far from satisfactory. Work has been started with the object of preparing a green paint that will keep its colour when exposed to the Egyptian sun. Specimens of red and black iron oxides, raw and burnt sienna, red and yellow ochre prepared from a natural deposit near Aswân were found to be of good quality, and it is thought that, given low treatment costs and cheap transport, the deposit might be worked with success.

Most of the consultative and advisory work related to petroleum, and in particular to its safe storage and handling; and research work also centred largely upon petroleum, for which a special staff and a separate laboratory were provided. During 1920 efforts were directed to determining the best large-scale methods of treating heavy grades of Egyptian crude petroleum, and producing from them the various refined products required in Egypt; and a method was worked out by which 24 per cent. of petroleum spirit and kerosene, 43 per cent. of Diesel oil, and 29 per cent. of pitch were obtained from dry Hurghada crude oil. Another important problem investigated was the elimination of brine from crude petroleum, and the most satisfactory method used was to heat the oil under pressure with superheated steam. Some brine-oil emulsion has been sent to England for further tests on this process with a view to overcoming the engineering difficulties. In view of the importance to Egypt of cheap supplies of cement and sulphuric acid, tests were made on the German process of heating very strongly an intimate mixture of gypsum and clay, and the results obtained were regarded as hopeful.

Mines and Quarries: General Report, with Statistics, 1920. *By* H.M. Chief Inspector of Mines. Pt. II.—Labour. *Pp.* 31—85. *London: H.M. Stationery Office.* 1921. *Price* 2s.

The year 1920 was noteworthy for the passing of the Mining Industries Act, under which the Mines Department of the Home Office was incorporated as a special Department of the Board of Trade (*cf.* J., 1920, 240, 278, 294 R). Regulations were issued under the Coal Mines Act, 1911, containing important provisions relating to prevention of danger from coal dust and spontaneous combustion, rescue work, etc. Research work was carried out at the Eskmeals Experimental Station on the following subjects:—The propagation of flame; ignition of gaseous mixtures; the composition and spontaneous combustion of coal; the passage of flame through wire-gauze, perforated plates, and tubes of small diameter; Mueseler chimneys; candle-power of flame-lamps; firedamp "caps"; electric lamps; the inflammability of carbonaceous dusts, and of solvent vapours (acetone, ether, etc.). The use of electricity in mines increased by 5·04 per cent. in 1920, the total horse-power of the electric motors then in use being 1,080,822. The number of coal-cutting machines rose by 591 to 5073, and 12·75 per cent. of the total output was obtained by machine-cutting, compared with 5·75 per cent. in 1910. (For Pt. I. of this Report *cf.* J., 1921, 239 R).

COMPANY NEWS.

Alby United Carbide Factories, Ltd.—The committee of shareholders appointed to confer with the board on the position of the company (*cf.* J., 1920, 279 R) found that the company's patents, which were valued in the balance-sheet at £373,449, would for the most part expire within a few years; that a contract had been made in 1912 to supply Nitrogen Fertilisers, Ltd. with 57,000 tons of carbide per annum for 30 years at £4 17s. 6d. per ton, but the cost of manufacture had risen to over £14 per ton; and that the contract made in 1912 for the supply of power was a further disastrous and recurring commitment. The directors found, subsequently, that the pressing liabilities of the company and of its 13 subsidiaries were greater than was supposed; there were heavy debts and no working capital. In order to reduce expenditure, the factories producing carbide, cyanamide, and nitric acid were closed and the ships laid up; and the electrode-factory at Hebburn is now in the hands of a receiver appointed by the Admiralty. The total debit balance on profit and loss accounts of the whole group at December 31, 1920, was about £500,000, liabilities for loans from bankers £693,613 (since reduced) and almost every asset has been pledged to creditors. The directors report that, on a forced liquidation, the balance of the assets would probably be insufficient to pay the creditors in full. The situation was rendered more acute because the Tyssefaldene Power Co. of Norway claimed possession of the carbide works at Odde on account of unpaid rent for power. Various negotiations entered into with the Power Co. and with Mr. Barton, on behalf of an English company, to take over the Odde works, were abandoned, and the Power Co. continued the proceedings for foreclosure. The total liabilities of the group, including guarantees, were over £850,000 at November 1, and the liquid assets, mainly pledged against loans, amounted to roughly £170,000. The directors now propose that the company be wound up.

Cassel Cyanide Co., Ltd.—At the annual meeting held on December 14, in Glasgow, Sir George Beilby, chairman, said that the company had not escaped the prevailing unsatisfactory industrial conditions, and shipments for the year had declined by 25 per cent. Competition from America and the Continent for Mexican business had been severe, and for the time being the company had been forced to yield ground in that important market. Shipments to South Africa had also decreased, and the consumption of cyanide in Australia was only one-third of what it was before the war. Some activity was observable in Northern Ontario. The state of the world's goldmining industry was unsatisfactory, but there was a better outlook for trade with silver-mining companies. Manufacturing costs had been reduced, and the working agreement with the Castner-Kellner Alkali Co. had been extended.

The net profit for the year ended September 30 was £56,774, exclusive of £10,498 received as interest. The issued share capital is £352,000, reserves stand at £61,875, and the total dividend for the year is 20 per cent., less tax.

Peachey Process Co., Ltd.—The first annual meeting of this company, which was formed to work Mr. S. J. Peachey's process of cold vulcanisation of rubber (*cf.* J., 1920, 376 R), was held in London on December 15. Sir John P. Hewitt, who presided, said that a building had been acquired in Willesden, equipped with plant and research laboratories, and placed under the supervision of Mr. Peachey with seven assistants. The company's exhibits were awarded a diploma of honour at the Fifth International Rubber Exhibition and also a diploma by the Rubber Growers' Association. Since the exhibition a very large number of inquiries concerning the process had been received from all parts of the world. Applications for patents had been made in 35 countries and granted in 15, and as a result of recent research work several additional patents were being applied for. Negotiations were proceeding for the grant of licences for the manufacture and sale of "Peachey" solution and for the curing of proofed fabrics, and arrangements had been made for the exploitation of the process in the United States, Ceylon, the Federated Malay States, and the Straits Settlements.

TRADE NOTES.

BRITISH.

Federated Malay States in 1920.—The annual report of the Commissioner of Trade and Customs states that the increased total value of the trade of the Federated Malay States in 1920 was due mainly to advanced prices, for in many cases there was a decline in the quantity of materials imported and exported. Tin-mining and rubber-growing, the two most important industries, were in grave difficulties at the close of the year, and it is suggested that capital be diverted to the extended production of sugar, copra, crops yielding oils, drugs, dyestuffs, etc., all of which are well suited to the country. Imports during 1920 increased by £3,027,835 to £19,894,247, the chief source being the United

Kingdom with £3,675,464. Exports rose in value by £1,117,736 to £33,683,498, first place being taken by the United Kingdom with £5,436,859. Rubber exports were 101,330 tons, worth £20,851,324; restriction of output had little effect and the decline was only 5126 t. The increased export of copra in 1919 was not maintained in 1920, but although 165 t. less was shipped, the value was much higher. Similarly the export of tin decreased by 2001 t. to 34,034 t., but the value rose by £1,580,261. Scheelite and wolfram ores were in smaller demand and the price of scheelite fell by one-half.—(*Official.*)

Barbados in 1920–21.—Practically the entire colony of Barbados is under cultivation; sugar-cane is the main crop, and others are cotton, sweet potatoes, yams, maize, and cassava. Owing to the continued droughts in 1920 the yields of all the crops were reduced, and the export of sugar (including molasses) fell from 69,628 t. in 1919 to 48,212 t. in 1920; for the same reason the 1921 crop is expected to be still lighter. Experiments with seedling canes were continued, but many of them will be valueless owing to the ravages of insect pests, which have been investigated by a special commission. The cotton crop was just under 45 tons in 1919—20, and was grown from improved seed produced locally; samples of cotton were submitted to experts in England and satisfactory reports obtained. The British Union Oil Co. continued to prospect for petroleum and in May, 1921, five trial bores were being sunk. Economically the year 1920 was the most prosperous in the history of the colony; exports were valued at £4,865,894 (£3,305,382 in 1919), of which the United Kingdom took 29·6, Canada 35·5, and the United States 15·9 per cent. Imports rose in value by £1,252,079 to £5,145,537, the share of the United Kingdom improving from 19 to 30·1 per cent., that of Canada remaining at 18·3 per cent., and that of the United States falling from 40 to 35·8 per cent. Imports of fertilisers from Brazil, Chile, and the Virgin Islands declined, but importations from Holland increased.—(*Col. Rep.-Ann.*, No. 1087, 1921.)

FOREIGN.

The Market for Drugs and Chemicals in Argentina.—European drugs and medicines are growing in favour in Argentina; owing to the high value of the dollar, their prices are from 40 to 60 per cent. below those of products from the United States. French and German firms in particular are making great efforts to extend their trade and credits. The United States, however, still holds a strong position, but England is competing closely in the soda market, and is also supplying many other chemicals. German chemical houses have not yet regained their former ascendancy in the Argentine market.—(*U.S. Com. Rep., Oct.* 10, 1921.)

Exports of Pulp and Paper from Norway.—The exports of wood pulp from Norway in 1919 and 1920 were as follows:—

	1919.	1920.
	Metric tons.	
Chemical pulp—		
Dry	132,933	211,291
Wet	791	381
Mechanical pulp—		
Dry	19,975	9,647
Wet	466,998	376,323

In 1919 Great Britain took over 50 per cent. of the exported wet pulp, and France, Holland, and Denmark most of the remainder. The export of wrapping paper fell from 82,907 t. in 1913 to 61,289 t. in 1920, but that of newsprint rose from 98,464 t. to 123,358 tons. Great Britain is also the chief market for Norwegian wrapping and newsprint paper (*cf.* J., 1921, 151 R).—(*U.S. Com. Rep., Oct.* 10, 1921.)

REVIEWS.

Technical Methods of Analysis as Employed in the Laboratories of Arthur D. Little, Inc., Cambridge, Mass. *Edited by* R. C. Griffin. *Pp.* 666. (*New York and London. McGraw-Hill Book Co., Inc.* 1921.) *Price* 33*s. net.*

The preface to this book disarms criticism. It has no pretension to be more than a collection of methods of analysis, most of which have been in use —and have thus proved their usefulness—for many years in the author's laboratory, and the rest of which are nearly all "standard" methods, emanating from the American Association of Official Agricultural Chemists and from the various United States "Bureaus" at Washington. There is for the most part no attempt to estimate the degree of accuracy of the methods, or to indicate the chemistry of the reactions which they involve. The usefulness of the book will depend largely on the circumstances of the user—his need, that is to say, for a method of making some of the determinations described in the book, his unfamiliarity with such method and his difficulty in otherwise discovering it; and, assuming the need of it, the chief question to be asked is whether the descriptions of the methods are clear and adequate.

The contents are very miscellaneous, and it is nowhere professed that system or completeness of survey is a character of the book. The headings of the chapters are—General Inorganic Analysis; General Organic Analysis; Metals; Fuels; Paints and Paint Materials; Oils, Fats, Waxes and Soaps; Wood, Paper, and Paper-making Chemicals; Textiles and Textile Fibres (or Fibers); Foodstuffs; and Miscellaneous; and it may be said at once in regard to all of these save the first two and the last, that there is nothing in the book for the specialist in any of these matters, nothing indeed for the general practitioner who has an ordinary acquaintance with them—but that an analyst whose usual work lies quite outside of one of them, and who is suddenly and exceptionally confronted with a problem on that subject, may find here sufficient to carry him through. As to the other chapters, the statement that in the contents of the first we have in juxtaposition table salt and sodium nitrite, waterglass and potassium bichromate, corrosive sublimate in medicated gauze and asbestos-magnesia pipe-covering, in those of the second nitrogen and methyl alcohol, albumin and tannic acid, and in those of the last soldering paste and waters, fertilisers and wood-preserving oils, spent oxide and mortar and concrete, will serve to indicate the justness of the adjectives "general" and "miscellaneous" in their titles.

The descriptions of manipulation are for the most part clear and sufficiently detailed, though the references are frequently, as might be expected, to American forms of apparatus (Tirrill burner, Coors glazed porcelain crucible, Emerson bomb calorimeter), and the objectionable use of formulæ for the names of substances ("make alkaline with NH_4OH and filter off any $Fe(OH)_3$ precipitate"; but "add tartaric acid and alcoholic solution of dimethylglyoxime") is adopted throughout the book. There is an introductory chapter on the preparation of reagents, in which the partial and incomplete use of this practice is very worrying—"The alcohol and KOH mixture," "Solution of alum (KAl sulfate) in water," "Dissolve ammonium carbonate in water and add conc. NH_4OH." Whatever excuse there may be for this kind of thing in hasty MS. notes of lectures, there is none for its occurrence in a well-printed, handsomely got-up, high-priced book.

There is a short bibliography at the end of each chapter and a more comprehensive one at the end of the book (these also largely of American sources of information), where also are tables of atomic and molecular weights, analytical factors, and amounts of various substances equivalent to 1 c.c. of certain "volumetric solutions." A considerable amount of labour has gone to the compilation of the book, which seems to have been carefully edited, and, as a volume, is very well produced; but, though it may be adapted to American conditions, it is hardly likely that English chemists as a body will find it very useful.

J. T. Dunn.

Fundamental Principles of Organic Chemistry. *By* Charles Moureu. *Authorised translation from the sixth French edition by* W. T. K. Braunholtz. *Pp.* 399. *(London: G. Bell and Sons, Ltd.* 1921.) *Price* 12*s.* 6*d. net.*

The text-books of organic chemistry, apart from those of a purely elementary character, may be divided into two classes, namely, those which hope to cater for the student who is passing through a course such as that required for an ordinary science degree, and those which are intended to fill up the gaps in a course of lectures given in a chemistry honours school in one or other of our universities or university institutions. Those falling within the first category have hitherto been written on stereotyped lines; the examples chosen to illustrate fundamental principles have been those which have stood the test of time and any spirit of heterodoxy has been carefully suppressed. With books of the second type the difficulty has always been to cover the ground in an adequate and interesting manner; in fact, to make a text-book and not a dictionary. Every teacher of advanced organic chemistry will agree that some text-book is necessary. The subject is so large and the time for instruction so short that it is quite impossible to cover the whole field in the hundred or so lectures which the time devoted to organic chemistry in the usual honours course permits. The lecturer is not, moreover, a free agent. Above his head, and above the heads of his students, looms the inevitable examination, at which he knows, and they know, that the questions set will be on certain definite lines. Indeed, our examination system sees to it that no lecturer shall deal with matter not in the examination syllabus. He must, above all things, be orthodox, and must not depart from the dozen or so subjects which he knows will form the basis of the forthcoming examination. These are the difficulties under which, not only our lecturers, but also our text-book writers suffer, and which handicap them when they try to introduce original methods into their lectures or books. It is therefore very welcome to see a text-book, emanating from a country not afflicted as we are, which starts off by breaking one of the fetishes which has dominated organic chemistry since its inception. Wöhler killed the theory of the vital origin of organic matter by his synthesis of urea, but no one, until Professor Moureu wrote this book, has had the courage to point out that the purely artificial division of organic chemistry into an aliphatic and an aromatic series has no real foundation, and that, for example, the difference between ethyl alcohol and phenol is only one of degree. Such a division is not only wrong in principle, but it has been harmful in practice, because it has often prevented the science from being taught in the only way which renders it intelligible and interesting to the student, namely, by contrasting the effect of difference of structure on chemical character. In the book under review the principles underlying the science are illustrated as they ought to be, by reference both to aromatic and aliphatic compounds.

Perhaps the most striking feature of the book is its complete up-to-dateness, the examples chosen being mostly those of recent discovery. The chapter on Stereochemistry is in every way excellent, and is one of the clearest and best descriptions of this important subject that has been published. The sections on Triphenylmethyl, Ethylene Hydrocarbons, Alcohols, Phenols, Aldehydes, Ketones, Ketenes, and Acids are written in such a manner as will render them of the greatest value to the advanced student who may wish to supplement his lecture notes. Indeed, one would hardly have thought it possible to produce a text-book which so nearly supplies the requirements of the two classes mentioned at the commencement of this review. Professor Moureu and his translator are to be congratulated on the achievement.

For the rest, one would like to have seen a fuller description of the nitrogen compounds, this important subject having been compressed within fifty pages. The translation is clear and concise and closely follows the French text. One notices the use of the word potash when potassium hydroxide is meant, but these are minor faults in a work which should appeal to all teachers of organic chemistry.

Jocelyn Thorpe.

Tanning Materials, with Notes on Tanning-Extract Manufacture. *By* A. Harvey. *Pp.* 182. *(London: Crosby Lockwood and Son.* 1921.) *Price* 15*s. net.*

Since the publication of Procter's "Principles of Leather Manufacture" (Spon, 1908) there has been no new English work containing a complete account of the available vegetable tanning materials. Many fresh materials have been discovered, and great progress has been made in the manufacture of extracts from tanning materials other than quebracho, but the information is very widely scattered, and the chemist is frequently unable to obtain access to the journals he requires. The present book should be very useful to him as a work of reference to the published literature.

The vegetable tanning materials are arranged in alphabetical order, and notes are provided on the varieties and tannin content of each one. In many instances both the tannin and non-tannin contents of the materials are given, but the composition of the poorer materials is dismissed merely with a reference to the approximate tannin content. The author expresses the hope that the volume will prove useful to the average tanner or manufacturer, but this hope is not likely to be realised, since the tanner and manufacturer are just as interested in the tanning properties as in the tannin content. In a few instances only is any attempt made to describe the characteristics of the various materials and their practical application. This section is open to very serious criticism in this respect, and also on account of the very cursory treatment of the extracts prepared from vegetable tanning materials. Liquid and solid extracts of myrobolans and oak-bark extract are worthy of much more attention than the author has devoted to them. The German leather industry owed its salvation largely to the oak-bark extracts manufactured in that country during the war. On p. 71 the statement that "an endeavour has been made in Germany to manufacture a tanning extract from pine twigs and pine refuse" is open to misconstruction, since this is the only reference to pine bark or pine-bark extract in the section on tanning materials. Yet pine bark is a most valuable tanning agent largely used on the Continent, and is included by authorities like Paessler and Ganswindt in their treatises on tanning materials.

The third section of the book forms a treatise on the general manufacture of tanning extracts. In contrast to the second edition, this is well written and freely illustrated with prints and diagrams of machinery, and includes all the processes in general use and many of those recently patented. This section will prove a useful introduction to the study of the manufacture of tanning extracts and of great interest to the general reader. The official methods of tannin analysis as formulated by the Society of Leather Trades Chemists and the American Leather Chemists' Association are outlined in the fourth section; and the last chapter is a miscellany, including remarks on the use of spent bark. The author has omitted to mention the patents of Blanc and Blockey for utilising spent tan, etc. as a reducing agent in the manufacture of one-bath chrome-tanning liquors. There is an error on p. 69, where osage orange is termed *Bois d'arc;* the true botanical name is *Maclura aurantiaca.*

D. Woodroffe.

Soil Conditions and Plant Growth. *By* E. J. Russell. *The Rothamsted Monographs on Agricultural Science. Pp. xii+406. (London: Longmans, Green and Co.* 1921.) *Price* 16*s. net.*

This volume, which is really the fourth edition of Dr. Russell's monograph in Messrs. Longmans' series of Monographs on Biochemistry, is announced as the first volume of a new series of "Rothamsted Monographs of Agricultural Science." Its aim is to give a general account of all aspects of the relationship between plants and the soil in which they grow. Subsequent volumes of the series by the heads of the various departments in which the extensive work of the Rothamsted Station is now organised, will appear in due course. Each volume will deal in detail with the literature of one special branch of the subject. If Dr. Russell's colleagues can maintain the high standard which he has set, the series will mark a new epoch in agricultural literature.

The success of Dr. Russell's volume and its usefulness to everyone interested in soil science can best be judged by the fact that it has gone through three editions and one new impression in nine years. Further comment on its excellence is almost unnecessary. The present edition has been largely rewritten and far exceeds the third edition in length and in scope. The historical introductory chapter which now covers 30 pages is specially interesting, and serves to give a sense of perspective to the whole subject. Other writers on technical subjects might well follow Dr. Russell's example in treating their introduction historically. Unfortunately, however, few writers possess his historical sense, and fewer still such a library as now adorns the Rothamsted Laboratories. The second chapter on conditions affecting plant growth, which contains much new matter, is also of wide general interest. Subsequent chapters are perhaps rather more specialised, but throughout the volume the author has treated every branch of his subject in a broad-minded and general manner which makes it eminently readable, and adds greatly to its value. Such a book spreads among agricultural teachers and students a mass of accurate and ordered knowledge of all branches of soil science. Dr. Russell's description of the evolution of each branch of the subject points the way for further research and provides an invaluable stimulus to those of his readers who have the opportunity to add to our stock of information about the soil.

The volume ends with three appendices on the methods of soil analysis, the amounts of various substances absorbed from the soil by the common agricultural crops, and a selected bibliography giving over 300 references. There are also excellent indexes arranged under authors and subjects.

To the agricultural chemist Dr. Russell's book requires no recommendation. The reviewer trusts he may be excused for recommending it to the botanist in the hope that its perusal may remind him that plants grow in the soil, and that there is now a literature dealing with the connexion between plant and soil which he can no longer afford to ignore.

T. B. Wood.

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Organic Synthesis: An Annual Publication of Satisfactory Methods for the Preparation of Organic Chemicals. *Vol. I. Edited by* R. Adams, H. T. Clarke, J. B. Conant, *and* O. Kamm. *Pp.* 84. (*New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.* 1921.) *Price* 8*s.* 6*d.*

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The Cleaning and Restoration of Museum Exhibits. *Report upon Investigations conducted at the British Museum. Department of Scientific and Industrial Research. Bulletin No.* 5. *Pp.* 12. (*London: H.M. Stationery Office.* 1921.) *Price* 2*s.*

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